
Nova School of Business and Economics

# Three Essays in Risky Behaviors

*Author:*

Mafalda Sampaio

*Advisor:*

Adeline Delavande

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# INTRODUCTION

This dissertation consists of three essays on the relationship between risky behaviors and social environment, including the strategic construction of conversational networks to discuss HIV related issues, the impact of social stigma on risky behaviors, and how subjective expectations from parents can influence childhood obesity. Understanding where people seek information and how they react according to the social environment is shown to be important in designing effective prevention policies and programs.

In the first chapter we investigate the formation of informal HIV conversational networks in rural Malawi. Using data from the Malawi Longitudional Study of Familes and Health (MLSFH), which contains detailed data on conversational networks, we compare the overlap of conversational partners between the network formed to discuss family planning and the one formed to discuss HIV-related issues. If networks were constructed randomly, there should be a high overlap in the composition of different networks for the same individual, as the establishment of a social link is costly. We find evidence that points toward a strategic behavior of individuals by concluding that people (1) vary the composition of their networks; (2) select partners to talk with about HIV who are able to provide them with new information, and (3) both men and women who perceive themselves to be less likely to be infected or to be less exposed to HIV risk consistently look for partners who can provide them with better information.

The second paper is a joint work with Adeline Delavande and Neeraj Sood. We estimate the causal effect of social stigma against HIV+ persons on risky sexual behavior in rural Malawi by using plausibly exogenous variation in stigma arising from the introduction of a radio campaign seeking to reduce social stigma. The effect of stigma on risky behavior is *a priori* ambiguous. On the one hand, higher stigma can lead people to disassociate from the stigmatized group and hence promote risky behavior. On the other hand, stigma can

be viewed as a social tax on being HIV+ and higher stigma may reduce risky behavior as a result. We find that an increase in social stigma is associated with an increase in risky behavior, including more partners and a higher likelihood of having extra-marital relations. This effect is mainly driven by the impact of stigma on men.

The third chapter of this dissertation tackles the childhood obesity epidemic, by introducing two new approaches: the subjective expectations that parents have about the probability of future childhood obesity conditional on their choices of energy intake and expenditure, and the distribution of decision-power within the household. To identify these two new explanations for childhood obesity we designed and administered a survey in seven primary schools that resulted in an unique dataset covering three districts from Portugal and 220 respondents. Evidence points to the conclusion that parents have accurate expectations about the impact of consuming soft drinks and having an active life. Nevertheless, parents tend to believe that limiting soft drink consumption plays a more important role in fighting childhood obesity, and under-value the importance of physical exercise. This leaves room for policy making in promoting the right balance in the energy intake and expenditure. Moreover, we show that parents who have a higher decision-power within the household and those who perceive a higher increase in the probability of obesity when increasing soda consumption, are the ones whose children drink less of such beverages.

All in all, this dissertation contributes to the literature of risky behaviors by shedding some light about how the social environment shapes individuals' attitudes and perceptions toward risky behaviors. Not only do people deliberately seek information, they also tend to opt for less risky behaviors when they have a clear image of the risk they face and they live in a tolerant society. This suggests that working on the quality of the society's values and information flow as a whole, could trigger a reduction in risk taking behaviors at the individual level.

# 1. STRATEGIC BEHAVIOR IN CONVERSATIONAL NETWORKS: SEEKING HIV-RELATED INFORMATION

## *1.1 Introduction*

Since the beginning of the pandemic, HIV is a major health problem responsible for over 25 million deaths (UNAIDS). It is estimated that 33.3 million people worldwide are infected with HIV/AIDS. In 2009, 1.8 million people died due to HIV/AIDS and another 2.6 million were newly infected. Although it has spread worldwide, it affects developing countries especially. Data from 2008 reported that over 68% (approximately 22.5 million people) of all infected people live in Sub-Saharan Africa.

Malawi has been one of the most affected countries, occupying the 8th position in country HIV prevalence rate (CIA (2011)). The first case of AIDS in Malawi was diagnosed in 1985, and the national prevalence peaked at 26 percent in 1998. Since then, national prevalence has declined steadily. The most recent data (UNAIDS) estimated that the national adult HIV prevalence rate was 11.9 percent in 2007 and approximately 930,000 Malawians were HIV positive. HIV-related complications cause 68,000 deaths each year. The HIV epidemic in Malawi is characterized by significant geographic differences in HIV prevalence, much higher in urban areas, at 17.1 percent compared with 10.8 percent in rural areas, though there has been a steep decline in recent years according to the UNGASS (2010). Although there is a lower prevalence rate in the rural areas, the epidemic remains a major concern in those areas, where 80 percent of Malawians live, and health services are often limited. Moreover, Malawi's epidemic is feminized and consequently children are affected by the epidemic by contracting the disease from their mothers. At the end of 2007, an estimated 91,000 children in Malawi were living with HIV, and more than half a million had been orphaned by AIDS. Faced with this human and economic drama,

researchers have joined policy-makers in the urge to find a solution for the devastating spread of HIV and have focused on understanding the determinants of risky behaviors, emphasizing the influence that the social environment has on such behaviors.

This study investigates the formation of informal HIV conversational networks in rural Malawi, comparing individual choices of conversational partners between one network created to discuss family planning methods and the one to discuss HIV related issues. It examines whether people choose different network partners to discuss different subjects and what the main drivers of their choices are. More specifically, we focus on the choice of potentially more educated partners and study the impact of the individual's perception of risk in those choices, i.e., if people who feel they are less likely to be infected choose different networks from those who believe they have a high probability of already having contracted HIV.

The understanding of the construction and architecture of social networks is of extreme importance for the implementation of HIV prevention campaigns. In developing countries, social networks are one of the main vehicles of information transmission and are likely to be one of the most important diffusion mechanisms of HIV prevention messages.[1] Hence, in order to boost the reach of health-related campaigns and to maximize their efficiency through an appropriate resource allocation, it is mandatory that policy makers have a clear knowledge about how and where individuals seek information. In fact, identifying the key players in each society, i.e., the ones that others seek information and knowledge from, would allow targeting the prevention messages in such a way that they would spread efficiently in the network. Moreover, targeting only a small group of individuals in a society would enable a cost-efficiency gain in mass media campaigns, which usually have limited funds.

[1] Several studies have attempted to model the process of diffusion of ideas and information through social networks, e.g., Jackson (1972); Holden (1987); Rosero-Bixby and Casterline (1993); Kohler 1997 Kohler (1997); Cubitt and Sugden (1998)).

Several studies have focused on investigating the formation and impact of social networks. Theoretical models of social network (e.g., Wasserman and Faust (1994), Brock and Durlauf (2001)) have posited that social interaction is an important determinant of behavior, and several papers have tested this influence empirically. For example, Behrman *et al.* (2002) investigate the impact of social influence and social learning in contraceptive methods use, while Gerland (2004) focuses on the impact of attendance to community events and the structure of conversations in HIV prevention strategies. Most of these studies assume that network formation is a random process according to which people are associated with an *ad-hoc* social network composed of individuals from the same village, kinship group, classroom, among others. This approach neglects the possibility of strategic behavior by the decision-maker, which most likely contaminates the estimated impact of the average network behavior on the individual's decision.

In a seminal work Manski (1993) shed some light on the issue by addressing the *Reflection Problem*. According to this theory, when a researcher tries to infer whether the average behavior in a certain group influences the action of the individuals that comprise the group, he has to take into account and distinguish the endogenous, the contextual and correlated effects: (1) the endogenous effects according to which the propensity of an individual to behave in some way varies with the prevalence of the groups' behavior, (2) the contextual or exogenous effects where the propensity on an individual to behave in some way varies with the exogenous characteristics of the group, and finally (3) the correlated effects where individuals in the same group tend to behave similarly because they face similar environments and have similar characteristics. While the first effect is usually what researchers are aiming at, the correct estimation of its magnitude requires the identification of all three. Having this identification in mind, Manski emphasized the need to collect richer data so that the impact of each of the three factors could be disentangled and correctly estimated.

Manski's line of research was then followed by several authors. For example, Behrman *et al.* (2002) concluded that the impacts of social networks on changes in contraception

practices in rural Kenya remained even after controlling for unobserved factors such as homophily; Helleringer and Kohler (2005) used a fixed effects analysis to show that social interactions on the subject of HIV/AIDS have significant and substantial effects on respondent' perceptions of the risk of HIV/AIDS, even after controlling for unobserved factors that affect the selection of social networks. Montgomery *et al.* (2001) examined the influence of informal social networks on the contraceptive behavior of reproductive-age women, using longitudinal data collected in six communities in southern Ghana. These authors acknowledge Manskis' worries but argue that results driven on four rounds of survey data, covering two years of reproductive experience, and employing stringent test criteria (the fixed-effects model) are promissing. Also, Conley and Udry (2001) exploited the learning process and consequent agricultural technology adoption in Ghana, by collecting an extensive set of data that allowed the identification of the different effects associated with social learning.

Although social networks appear to have a relevant role in all health-related issues, their importance is likely to increase when *(i)* the uncertainty about a given subject is greater leading people to seek information and *(ii)* the availability of other information sources is limited. The spread of a fatal disease like AIDS in a developing country fits this scenario perfectly. At the initial stage of the HIV epidemic, individuals were forced to face a frightening new reality. As Kohler *et al.* (2007) argued, when confronted with this new threat people are likely to seek information about transmission mechanisms of the disease, which behaviors increase the risk of infection, and potential prevention strategies, in their closer networks, especially through the interaction with friends and neighbors. In this context of the AIDS pandemic Kohler *et al.* (2007) argued that social networks are determined by: *(i)* the costs and benefits of learning about the existence of the disease, its risks, and prevention strategies, *(ii)* the social constraints imposed by the availability of suitable network partners and the social acceptability of communications about such delicate issues, and *(iii)* the expected reduction of uncertainty about AIDS risks or about prevention methods which depends in part on network partners' knowledge. Bearing this

theoretical point in mind, any policy targeted at shaping individuals' sexual behavior should not only acknowledge the impact, but also the factors that determine the choice, of social networks.

This study lays out a simple theoretical model where an individual's network partner choices are a function of the costs and benefits that each relationship yields. Defining costs as the social distance that measures the geographical or cultural differences between the two potential partners, in order to address the homophily concerns, and benefits as to the amount and nature of the information that each potential partner can provide, we argue that each individual will decide to establish a new relational link only if the net benefit is positive. In fact, if networks were constructed randomly, there should be a high overlap in the composition of networks formed to discuss different issues for the same individual, as the establishment of a social link is costly[2].

In order to empirically test our predictions we use data from the Malawi Longitudional Study of Families and Health (MLSFH), which contains detailed information on conversational networks. We compare the overlap of conversational partners between the network formed to discuss family planning and the one formed to discuss HIV-related issues. A unique feature of the MLSFH is that it collects data about social networks by asking each sampled individual to name up to four persons with whom they chat about each issue, separately, and collecting a set of characteristics about these network partners.

In our analysis we focus on the family planning network as the pool of potential partners to discuss HIV related matters and analyze the main characteristics that increase the probability of a person being chosen as partner in the HIV network. Using a linear probability model, including individual fixed effects to wipe out any unobserved heterogeneity, we find evidence that points toward a strategic behavior of individuals by concluding that (1) people vary the composition of their networks; (2) people select partners to talk about HIV who are able to provide them with new information; and (3) both men and women

[2] Although, theoretically, complete randomness in the allocation of network partners could imply complete overlap between different networks, we acknowledge that people may only have the opportunity to chat with someone once. This would mean that the overlap might not be perfect.

who perceive themselves to be less likely to be infected consistently look for partners who can provide them with better information. Nevertheless, the characteristics that men and women seek in their conversational network partners are different. While women specifically seek those who have achieved a higher degree of education, men reach out for those who are likely to listen to quality information on the radio, newspaper, etc.

The remainder of the chapter is organized as follow. Section 1.2 presents a simple theoretical framework. Section 1.3 describes the data and Section 1.4 presents the descriptive statistics of the analytical sample and their social networks. Finally, Section 1.5 shows the empirical analysis and results and 1.6 concludes.

## *1.2 Model of Network Formation*

### *1.2.1 A Simple Theoretical Framework*

We present a simple theoretical framework that delivers testable predictions of the determinants of network formation. To formalize this approach we follow the non-cooperative model of Bala and Goyal (1999), in which the authors build a model of network formation with heterogeneous players. In their model each individual has a net benefit of creating a link that is given by the difference between the value of the link ($V$) and the cost ($C$). The most appealing feature of this model is that both the benefit and the cost allow for heterogeneity in characteristics of both the individual and the partner, so that they can depend simultaneously on the characteristics of both partners involved.

Introducing some notation, let $i$ be the individual (ego) that is deciding on the size and composition of his social network and $j$ be a potential partner (alter), such that they have the possibility of belonging to the same network $g$, centered on $i$. We refer to the link between agents as $ij$, such that $g - ij$ represents the network without such link and $g$ the network if agent $i$ decides to establish the relationship. Hence, individual $i$ will have utility $U_i(g)$ from the network $g$, establishing the link with $j$, and $U_i(g - ij)$ when deciding to keep $j$ out of the network.

For each individual $i$ there is a pool of potential partners, from which he has to form his network. In our context, including an individual in the social network means that the potential partner is referred to as one of the persons $i$ chats with about a given subject. Let $Y_{ij}$ be a binary variable that equals one if the link is created, i.e., if agent $j$ is included in $i's$ network, $g$. Again, as we are discussing unilateral link nomination, $Y_{ij}$ will equal 1 if $i$ nominates $j$ in his conversational network, and we can have $Y_{ij} \neq Y_{ji}$. The choice of $Y_{ij}$ referring to unilateral link relies on the nature of our networks. As we are dealing with conversational networks, where people chat with each other, there is no enforcement of sharing or perpetuating a relationship, so the decision of talking about a given subject relies only on the individual who initiates the conversation.

Generally, when an individual decides to establish a relationship he incurs a cost $C_{ij}$ specific to that link. This cost can represent social concerns such as the shame of talking about HIV, in order to avoid association with the disease, mobility constraints that makes it difficult for people to meet to discuss any aspect. The cost therefore depends on the difference between own and alter's characteristics, which hereinafter we refer to as social distance. These homophyly concerns have been widely discussed as some of the main drivers of social interactions (See McPherson *et al.* (2001), for example). Hence, $C_{ij}$ is expected to be positively correlated with the social distance. Formally, we can think of each individual as being fully described as a set of attributes $X_k, k = i, j$. The distance between those individuals will be the difference between those attributes. Given individuals $i$ and $j$, the cost of forming $Y_{ij}$ is given by $C_{ij} = C(|X_i - X_j|)$, where $C(.)$ is a weakly increasing function.

On the other hand, each conversational link yields a benefit $V_{ij}$ that depends on the information obtained through the potential partner $j$. This information measure can represent knowledge about the existence of the disease, prevention strategies, treatments available, or other specific knowledge on the subject. This partner-specific knowledge is represented by the vector $Z_j$. Also, the ability of the potential partner to provide new

information will play a role in the decision to establish the link. This will be measured by the relative number of connections of individual $j$ with the rest of the network, $\phi_j = \frac{L_j}{\binom{N}{2}}$, where $L_j$ is the number of connections between individual $j$ and the remaining members of the network, and $N_i$ is the size of the network. We call this measure the relative connectedness of each network partner and it represents the contribution that each makes to the network density.

If $j$ is very connected with all other members, the network will become denser, and the information he provides can soon become redundant, because it is likely that close individuals share information with each other, crowding out the flow of new knowledge. Considering only this effect, we would anticipate that people would rather choose more isolated partners to seek information from. However, they may be reluctant to discuss certain things with complete strangers, as it is costly to engage in such conversations due to the shame of talking about HIV-related issues, and require a certain level of "familiarity" that is not possible in a sparse network. Overall, the influence of relative connectedness on link formation can be described by two channels: on the one hand, people could need a certain degree of closeness, according to which potential partners with more common connections will be preferred. This means that we might expect a positive impact of the degree of connectedness of the potential partner on the likelihood to establish a link. On the other hand, from a given point on, information will become redundant, so individuals will choose partners further away. Behrman *et al.* (2002) have used the concept of density of the social network to exploit the distinction between social learning and social influence in fertility decisions on rural Kenya. Our analysis departs from this in several original ways: (1) it uses the relative density of each partner, i.e., the individual contribution of each potential partner to the overall density; (2) we focus on the overlap between two networks and not on one particular network; (3) we exploit the manner in which a particular individual chooses the composition of the network and not how does this composition affects his behavior.

As stated at the beginning of this section, one of the main characteristics of this

framework is that it allows for heterogeneity from both individual characteristics simultaneously in costs and benefits of the relationship. This enables us to evaluate how one's characteristics shape their incentives to seek information, as it is likely that each individual has a different incentive, which is determined by one's preferences or attributes. In our setting we are interested in how the individual perception of the likelihood of being infected with HIV influences the decision to seek information. Let $H_i$ be this risk perception measure defined such that a higher level of risk perception will increase the value of $H_i$. According to our setting the net benefit for individual $i$ of having a conversational link with $j$ is given by:

$$u(ij) = V(Z_j, H_i, \phi_j) - C(|X_i - X_j|) + \epsilon_{ij} \tag{1.1}$$

where all the variables are as explained above and $\epsilon_{ij}$ represents a random component of the individual utility. When the individual is choosing the network he will consider:

$$U(g) = f(u(i1), u(i2), ..., u(iN)). \tag{1.2}$$

For both networks (with and without the link $ij$) to be in the individual's choice set they must grant at least a certain reservation utility, $\underline{u}$ which is the utility without any network. If individual $i$ decides to include $j$ in the network it must be that:

$$U(g) \geq U(g - ij). \tag{1.3}$$

Considering one link at a time, the ego of the network is choosing individually whether or not to include one potential partner in the network depending on the net benefit of such link. The individual will choose to form the link if he or she obtains an expected positive net benefit, meaning that the probability that the link is formed is given by:

$$P(Y_{ij} = 1) = P(V(Z_j, H_i, \phi_j) - C(|X_i - X_j|) + \epsilon_{ij} \geq 0). \tag{1.4}$$

We assume that $\epsilon_{ij}$ are independent across pairs $(i, j)$, are independent of $\epsilon_{ji}$ [3] and that $\epsilon_{ij}$ have a normal distribution.

The number of individuals from the family planning network that the ego decides to include in the AIDS network will then be given by a function $g(.)$ of the costs and benefits of each potential partner:

$$\sum_{j=1}^{N_{FP}} Y_{ij} = \sum_{j=1}^{N_{FP}} g(Z_j, H_i, \phi, X_i, X_j, \epsilon ij), \tag{1.5}$$

where $N_{FP}$ is the number of network partners in the family planning network. With the assumption that the overall number of partners chosen from the family planning network to belong to the AIDS network is the sum of the individual decisions, the proportion of common partners (defined as the number of common partners over the family planning network size) will be a function of the average social distance, average relative density, and average information value. This chosen set is a measure of selectivity as we would expect that, given the inherent cost of establishing a link, the overlap would be maximum. Overall we would expect that an information seeking individual would require sparser networks in order to diversify knowledge, and would be linked to individuals that are better informed.

## *1.3 Data*

### *1.3.1 Malawi Longitudinal Study of Families and Health*

The data for this paper come from the Malawi Longitudinal Study of Families and Health[4] (MLSFH), whose goal is to study the role of informal conversations in changing behavior and attitudes toward family planning and HIV/AIDS in rural Malawi. This project began in 1998 (MLSFH-1) and was conducted in three districts of rural Malawi: Rumphi, Mchinji, and Balaka, representing the North, Center, and South of the country respec-

[3] When links are bilateral it is likely that $\epsilon_{ij}$ and $\epsilon_{ji}$ are correlated, in which case our independence assumption would lead to incorrect inference. See Fafchamps and Gubert (2007) for an example of such a situation with dyad-corrected standard errors.

[4] The study was initially named Malawi Diffusion and Ideational Change Project.

tively. After this first set of semi-structured interviews, five more waves were carried out in 2001, 2004, 2006, 2008, and in 2010. Although the sampling strategy was not designed to be representative of the national population of rural Malawi it has been shown that the sample characteristics closely match the characteristics of the rural population of the 1996 Malawi Demographic and Health Survey.[5]

In our paper we use the 2001 (MLSFH-2) wave for data availability reasons. The first (MLSFH-1) wave was carried out in the summer of 1998 and the panel survey included 1,541 women of childbearing age who had married at least once and 1,198 men, from which 1,065 were male spouses of the included women. The second round of the survey (MLSFH-2) followed-up the same respondents (excluding those who were reported as deceased in the 1999 Family Transfers Project and women who had reached an age over 49) and also interviewed the new spouses of respondents who had changed marital status between the two survey rounds (the total number of interviewees in 2001 was 1,571 women and 1,097 men including 186 new wives and 28 new husbands).

The MLSFH goal is to study the role of informal conversations. It collects information on two important egocentric informal conversational networks: family planning and AIDS, which are big topics of conversation in the communities studied due to the recent adoption of modern contraception methods and the magnitude of the HIV/AIDS epidemic in the country (Schatz (2002); Zulu and Chepngeno (2003)). The survey collects data on these two informal conversational networks in two different sections of the questionnaire, where each begins by inquiring about the size of each network:

- *F9b - How many people have you chatted with about modern methods of child spac-*

[5] There are numerous papers on the survey methodology of the MLSFH project, namely of the assessment of the quality of the data collected by the project's surveys. Bignami Van-Assche *et al.* (2003) takes advantage of the panel nature of the study, as well as of a set of re-interviews conducted in the MLSFH-2 to examine the consistency of responses for respondents interviewed by the two waves of the Malawian survey and finds that the re-interviewed respondents are overall consistent in their answers and that, when there are inconsistencies, they do not significantly affect the conclusions that can be drawn from multivariate analyses of the survey data. Also, Bignami Van-Assche *et al.* (2003) examine several methodological issues: interviewer effects, question reliability, and sample attrition using the 1998 and 2001 Malawi surveys.

*ing/family planning? I mean people other than your husband or partner.*

- *A24b - How many people have you chatted with about AIDS? I mean people other than your husband or partner.*

After asking freely about the network size, membership in a respondent's network is determined via one name generator, which is based on free recall of up to four alters. For each of the four alters enumerated a set of characteristics was collected including gender, residence, education, religion, strength of relationship (divided between confidant, just a friend, acquaintance, and met just once or twice), nature of relationship (divided between family, friends, or other), location, and a set of questions about knowledge and use of family planning (for networks on family planning) and knowledge, attitudes, and behaviors toward AIDS (for networks on AIDS). A detailed exposition of the questions posed to individuals is presented in the Appendix. Finally, the respondents were asked about the relationships between the two sets of network partners they identified.

## *1.4 Descriptive Statistics*

### *1.4.1 Analytical Sample*

The descriptive statistics of our analytical sample are presented in Table 1.1 and are separated by gender. Due to the construction of the survey the majority of the sample is married (97% of men and 91% of women). As for schooling, although most of the population has primary schooling, there is a higher schooling level for men than for women, with 17% of men (34% for women) without schooling. Furthermore, we see that earnings (measured in hundreds of *kwachas* at current prices) are much higher and less volatile for men than for women. An alternative measure of the economic status is the roof material since, due to the replacement requirements of each material, a metal roof is seen as a measure of wealth when compared to thatch. According to this measure, there is an even distribution of wealth by gender, as it represents the wealth at the household level.

### *1.4.2 Descriptive Statistics of the Social Networks*

Table 1.2 reports the composition of the informal conversational networks formed to chat about family planning and HIV related issues. Starting with the overall composition we see that family planning networks are smaller than the AIDS counterpart, and in both situations men tend to choose more conversational partners. Moreover, both networks are particularly dense[6], the latter being even denser (94% of the partners are connected, while in the first network this share falls slightly to 90%).

In both networks there is a high gender clustering, where the majority of people choose conversational partners of their own gender. However, one important remark should be made: men seem to gender diversify more when talking about family planning, reporting 14.4% of women in their family planning network against 5.3% in the AIDS network. This result suggests that men seek information on contraception methods from women, who are more likely to be informed about such methods, while they talk more about sexual transmitted diseases, that are linked with their own risky behaviors, with other men. Depending on the network or gender, between 43% and 54% of the partners are friends. Education of network partners follows the same pattern as education of respondents, with about 60% of the partners having primary education.

An insightful analysis at this point is to check for significant differences in size and composition of both networks. T-statistics of such differences are reported in Table 1.3. Men and women have similar behaviors when forming family planning and HIV conversational networks: for both genders the AIDS network is higher as well as denser. This suggests that although individuals are trying to reach more information, they are not diversifying their connections to a greater extent, which might indicate the cost of establishing a link discussed in 1.2. Both men and women significantly decrease the proportion of in-law relatives in their networks which, is consistent with the reluctance to discuss sensitive issues. Concerning the potential information that each network partner may

[6] The density was computed by dividing all relationships between network members by the total possible connections between the network member.

provide the individual, data show that women have a higher proportion of partners with secondary schooling in the AIDS network as well as trained partners, while men prefer those who listen to family-planning and AIDS information on the radio. Overall results show for both men and women significant differences in the composition of the networks, which strengthens our selectivity theory.

Finally, a useful measure is the proportion of individuals common people across both networks. According to our reasoning, if people were not choosing strategically their network partners, and were randomly allocated to a set of individuals, the relationships built to discuss different subjects should not vary much, as establishing a link is costly. This would mean that the overlap between both networks should be large. Data show that the proportion of common partners across both networks is 27% and 24% for men and women, respectively. This reinforces the idea that an individual, when deciding whether or not to establish a conversational relationship measures the benefits that that potential partner brings.

## *1.5 Empirical Analysis*

### *1.5.1 Network Selectivity*

#### *Econometric Specification*

Our main objective is to investigate the determinants of establishing a conversational link between two potential partners. More specifically, we wish to understand if an individual chooses, from among the pool of partners with whom he discusses family planning matters, the ones that he perceives to provide him the most valuable information to chat with about AIDS.

As suggested in Section 1.2, one of the key issues in network formation modeling is the definition of the pool of available partners. In the context of rural economies, researchers typically use the residents of the same village to proxy the possibilities of connections for each individual (see Fafchamps and Gubert (2007) and Conley and Udry (2001), for

example.) Not only do these proxies perhaps inaccurately represent one's possibilities of interaction, but they also are only possible to identify when the whole population is surveyed. As a way to overcome these limitations of the standard definitions of possible network links, we investigate whether people are strategically choosing those with whom they chat by focusing on the family planning issues conversational network, as the pool of available partners. From this set of possible links, we investigate how these network partners are chosen to be part of the network built to discuss HIV-related matters.

This approach is key to our analysis: first, it is a natural candidate for the pool of available partners as it refers only to individuals with whom the respondent can relate with relative ease, so that they are actually in the choice set. Second, and more importantly, this approach allows us to assume that the establishment of this new conversational topic is a one-way decision, as the decision to initiate a conversation about an alternative topic is likely to be unilateral.

We posit that once a relationship is established, the decision to talk about a different subject is driven by *(i)* the social distance between individuals, i.e., the difference in their attributes, and *(ii)* the information that the potential conversational partner can provide the individual with, on that particular subject. Assuming that an increase in information is never costly, we have that only the person who initiates the conversation bears the social distance cost. For this purpose we rely on the model presented in Section 2 and assume a linear function of the variables introduced. To estimate our parameters we consider the following empirical specification:

$$Y_{ij} = \alpha Z_j + \beta Z_j H_i + \gamma \phi + \delta \phi^2 + \zeta |X_i - X_j| + f_i + \epsilon_{ij} \tag{1.6}$$

Where:

- $Y_i$ is a binary variable that assumes the value one when agent $i$ chats about AIDS with the family planning conversational partner $j$.

- $Z_j$ is the perceived level of information provided by the potential partner (whether he has a higher education level than the respondent, whether he listens to informational programs on the radio about family planning, or whether he is considered a trained network partner, e.g., nurse, doctor, VCT counselor).

- $H_i$ stands for the incentive for information seeking that is measured by the risk perception (see below for detail).

- $\phi$ is the relative density of potential partner $j$ within the AIDS network of individual $i$.

- $|X_i - X_j|$ represents the distance between the two potential partners and includes whether they are from the same gender, whether they live in the same household, village, compound, traditional authority, district or elsewhere, whether they are friends, relatives, acquaintances, or have a more distant relationships and whether they share the same religious habits.

- $\epsilon_{ij}$ is a random term.

To account for any individual unobserved tendency to have larger networks, and since we have up to four observations per individual (one for each family planning network partner), we include individual fixed effects. This inclusion limits us to the use of linear models due to the incidental parameter problem, according to which the maximum likelihood estimator for a probit or logit model with fixed effects is both biased and inconsistent (Neyman and Scott (1948) and Lancaster (2000)). Standard errors are robust and clustered at the individual level.

Below we present a detailed description of the included variables, especially those that are more important to our identification model.

*Heterogeneity in benefits from adding a link depending on ego's characteristics - Incentives for Information Seeking ($H_i$)*

We wish to investigate whether or not there are specific characteristics that systematically and significantly lead to different choices of networks. For this we distinguish individuals

according to their perception of being infected with HIV. This perceived likelihood was obtained directly from the questionnaire:

- *A41a - In your opinion, what is the likelihood (chance) that you are infected with HIV/AIDS now?*

Possible answers are *High Likelihood / Medium Likelihood / Low Likelihood / No Likelihood*. For our purposes we construct a binary measure distinguishing between those who report a high or medium perceived likelihood from those who report none or a low likelihood.

At the bottom of Table 1.1 we describe individuals according to the perceived likelihood of infection and we see that overall, people perceive themselves as having no or low likelihood of being infected with HIV/AIDS. This result is even sharper for men, where 72.1% report not being infected, compared to 61.2% for women.

*Heterogeneity in benefits from adding a link depending on alter's characteristics - The Information Value ($Z_j$ and $\phi$)*

We posit that people act strategically when building their social networks meaning that the characteristics of the potential partners are likely to play a significant role. According to this strategic behavior individuals are seeking reliable information, such that they choose as network partners those who are perceived to provide them with the most helpful information. We distinguish between the specific individual information that each network member can deliver and the relative increase in information. We define as individual-specific information the pieces of knowledge that can be assessed by the decision-maker about the potential partner from their interaction in the family planning network. We focus on:

- Higher Education - whether or not the potential partner has achieved a higher education level than the respondent

- Trained Partner - whether or not the potential partner is a family planning counselor, nurse, doctor, or health surveillance assistant

- Radio Information - whether or not the potential partner listens to news about family planning on the radio.

At the bottom of Table 1.2 we report the proportion of network partners with, respectively, a higher education than the network partner, is training in health-related issues, and listens to information about family planning on the radio. Data show that, on average, 20% of the peers have a higher education than the ego of the network. The other information measures have a lower variability, with 2% of trained network partners and 95% listening to information on the radio.

Concerning the relative information value, we focus on the relative number of connections that each potential partner has, as it measures the degree of new information inflow in the network. According to the theoretical model, the ideal measure would be the connections that each potential partner had with the members that were included in the network at that point in time. Our data have the limitation of not providing the chronological order according to which links were made, which prevents us from measuring the relative connectedness of each potential partner with the alters already present in the network. As an alternative measure, we capture this effect using the relative connectedness of each potential partner with all members of the network, regardless of the timing on entrance. We rely on the following question:

- *Finally, I would like briefly to ask you how well all the people you told me you chat with about both AIDS and family planning know each other. For each pair that I mention, please tell me whether they are confidants, just friends, acquaintances, or they do not know each other.*

We construct a measure $\phi$ that represents the relative density of each member of the family planning network partner with the members of the AIDS network. This variable is defined as the number of connections that each partner has with the all members of the network (family, friendship, or other) over the total number of possible connections. This relative density will measure the novelty of the information as it is likely that the higher the degree of connectedness the potential partner has with the remaining network

partners, the more likely it is that they have already shared information and hence, the less useful it will be. In our analytical sample, the average relative density from each network partner is 56%, with a standard deviation of 21%.

As stated in Section 1.2, the relative density is likely to have a non-linear effect. On the one hand, individuals should require a given level of familiarity between individuals in order to chat about sensitive issues, such as HIV, meaning that people would prefer to establish relationships with those who are already connected with the rest of the network. On the other hand, as the degree of connectedness increases, the novelty of the information that potential partner provides decreases, meaning that from an information seeking perspective, that partner is less useful, which should reduce the probability of link between the two individuals. We exploit this non-linear relationship between the relative density and the probability of a family planning network partner being chosen to be part of the AIDS network partner by including in the regression both the relative density and its square.

*Heterogeneity in cost depending on social distance ($|X_i - X_j|$)*

Our theoretical model suggests that one of the main determinants of the establishment of a link between two potential partners is the cost of beginning and maintaining such relationship. Sociologists and economists have long studied the homophyly phenomenon, according to which people tend to relate with those potential partners that are more alike.

In order to capture the homophily concept, we have focused on four different dimensions of social distance: gender, location of network partner relative to the individual, type of relationships and relative degree of religiosity. With this set of variables we seek to measure the physical and social distance between the respondent and the potential partner. For the gender effect we constructed a binary variable that represents whether the two have the same gender. To measure the relative location of the network partner we used a categorical variable that indicates whether they live in the same household, same compound, same village, same traditional authority, or further apart. For the type

of relationship, we distinguish between friendship, own-relatives, in-law relatives, other relatives, acquaintances, or further apart. Finally, as a way to measure the degree of religiosity, we use the habit of becoming a New Born[7] if one is Christian or making Tauba[8] if one is Muslim, by constructing a categorical variable that indicates if they had the same behavior toward their own religion [9].

Table 1.4 reports the social distance descriptive statistics. As seen above, the majority of individuals choose gender-according conversational partners although men report a higher proportion of women in their AIDS network compared to the family planning counterpart. Also, we see that, on average, 80% of the network partners are from the same village or traditional authority. An important analysis should be made at this point: there is an important difference between the location of the individuals chosen to discuss family planning issues and the ones chosen to discuss HIV-related issues. In fact, men (women) report less 6.6% (16.7%) and 13% (35%) of network partners living in the same household or compound and in the same village, respectively, on the AIDS network. Moreover, they report an increase of 17.7% (35%) of network partners from the same traditional authority. This pattern of location suggests that when the relationship is formed to discuss HIV-related matters, that are likely to be more sensitive and to involve riskier behaviors, individuals choose partners that are further away. This pattern is also present in the type of relationship, with the decrease of the share of the in-law relatives.

Concerning the degree of religiosity[10], measured by the decision to make a strong religious commitment by becoming a Born Again (if the individual is Christian) or to making Tauba (if the individual is Mulsim), we have that most links appear between

[7] Born Agains created moral geographies from the ideological position of Christian Fundamentalim and thereby came to a number of different conceptualizations of what the good and evil spaces actually are and how they can be established. From the early 1970s, Malawi's urban centers saw the rise of a number of Christian fundamentalist groups and organizations led by young itinerant preachers, that preached a doctrine of strict morality.

[8] Tauba in Arabic literally means to return, i.e., acts of leaving what God has prohibited and returning to what he was commanded. It has been appointed as representing an equivalent religious commitment as the Born Again for Christians, if the individual is a Muslim.

[9] Since the goal of the categorical variable is to evaluate the degree of religiosity, which might be observed as the degree of conservatorism, it treats equally the pairs that are religion-accordant or the ones that have one partner from each religion, focusing only on the commitment toward the respective religion.

[10] According to the World Christian Database in 2009, 79.9% of the Malawi population was Christian and 12.8% Muslim.

individuals that have not engaged in such commitments. However, the data show (not reported) that 40.46% of network partners of individuals that have made Tauba have also made it, while the analagous proportion for respondents who have not made Tauba is only 4.28%.

*Results*

Results are presented in Table 1.5. The model is estimated by Ordinary Least Squares (OLS) and results are split by gender. Odd columns present estimations for men, and even for women. In columns 1 and 2 the information variable considered is whether or not the potential partner has a higher education than the individual, columns 3 and 4 whether the potential partner listens to radio information about family planning, and in columns 5 and 6 we consider whether he is a trained partner.

The main goal of this paper is to study if people are strategically seeking information. The overall level of new knowledge of a potential partner is measured by his relative connectedness with the remaining members of the network. The higher the degree of connectedness, the lower the novelty of the information. Nevertheless, each ego may require a certain level of familiarity to chat about HIV. This prediction is confirmed empirically, through the coefficient estimated for both the relative connectedness of each partner and its square. For men the probability of the link being established increases until the relative connectedness reaches 61%. The maximum impact is achieved when it reaches 30%, where a marginal increase in $\phi$ increases the probability of the potential partner being included in the AIDS network by 27 p.p. For women, the maximum impact is lower (21 p.p.) and is obtained when the relative density is 28%. While this could suggest that women value more the diversification of information, in spite of the impact on the probability of link establishment being lower, differences across genders are not large.

People base their decisions not only on the overall novelty of information, but also on

the perceived specific knowledge of the potential partner. Results show that both men and women are strategic in network formation, specifically targeting individuals who are expected to provide them with better information. However, the characteristics that they use to infer the access to information from their partners are different. Women who have a low likelihood of being infected increase the probability of establishing a link with a potential partner by 12.4 p.p. if he has a higher education level. Men who perceive themselves not to be infected increase the probability of establishing a link by 18.6 p.p. if the potential partner listens to news and information slots on the radio. Overall we have that people believing themselves not to be infected value their HIV negative status, and try to preserve it. As they believe they have something to protect, they seek information from more qualified partners in order to maintain their HIV- status. This significant difference between behaviors according to the perceived likelihood of infection could reveal a fatalistic behavior from those who believe themselves to be infected.
The social distance results reflect the pattern that was already anticipated by the descriptive statistics. Men have an increased probability of talking with men about HIV/AIDS and across all specifications women talk more with those potential partners that are geographically closer.

In conclusion, we find that people target specific individuals in order to access information. This conclusion provides valuable guidelines to mass media campaigns. Information campaigns do not substitute for social networks because people look to their peers for information, especially for new and qualified one. Therefore, campaigns could focus on identifying the key players in each network and target those individuals. As individuals strategically seek information in their network, this will improve the efficiency of the message in a two-fold way: on the one hand, it is a way of passing the information at stake to the social network level. On the other hand, as it should target only a subset of the population rather than the whole, it must be cost-efficient.

### *1.5.2 Overlap Between Networks*

#### *Econometric Specification*

Choosing one by one whether or not to chat with a potential partner about HIV, each respondent ends up creating a conversational network. Another measure that helps us understand how the individual is creating and shaping the network, working as a robustness check for the previous results, is the proportion of common partners between both networks. We define this proportion as the total number of partners from the family planning network that the individual chooses to be part of the AIDS network divided by the family planning network size. To model this decision we rely on the following econometric specification:

$$\begin{aligned} prop\_common_i &= \alpha * average\_Z_j + \beta * average\_H_i * Z_j + \gamma * average\_\phi + \\ &\quad \delta(average\_\phi)^2 + \zeta * average\_|X_i - X_j| + \eta * X_i + \epsilon_i \end{aligned} \tag{1.7}$$

where $prop\_common_i$ stands for the proportion of common partners between the two networks and $X_i$ is a set of controls for the respondent[11] (risk perception, age, age squared, education, earnings, the number of children, and the roof material). All the other variables are the same as defined before. Also, standard errors are robust to heteroskedasticity.

#### *Results*

Results are presented in Table 1.6. This robustness check confirms our findings on the individual selection of each network partner. We find that the average relative density has a non-linear effect on both men and women. It increases the proportion of family planning network partners chosen to be part of the new network up until a relative density of 82% for men (88% for women). This reinforces our argument that people require

[11] As we are looking at one decision per individual in a cross section (and not relying on the dyads) we cannot use fixed effects, and hence must control for individual characteristics.

a given level of familiarity between network members up until the point the information that circulates within the network becomes redundant, when the individual starts seeking partners elsewhere. Considering our individual information measures, the data show that, on average, men do not vary the proportion of common partners according to the average information level. However, women report a behavior that is consistent with what was found previously at the individual level: women who are less likely to be infected with HIV report a higher overlap the higher the proportion of network partners who listen to news on the radio. In fact, if the proportion of people who listen to the radio increases by 10 percentage points, the proportion of family planning network partners chosen increases by 1.1 p.p. Moreover, we find that women who perceive themselves to be infected significantly decrease this overlap the higher the proportion of trained partners. This last finding might suggest an alternative mechanism behind the strategic formation of social networks according to which people who believe themselves to be infected distance themselves from qualified nurses and doctors who can identify them as HIV positive, in order to keep their status in secrecy. Being so, health professionals should reinforce the fight of social stigma when thinking about their line of action, as well as consider explaining the benefits of anti-retroviral therapy in order to give the proper incentives to infected individuals. More, since this effect is only significant in women, a campaign that focuses on the possibility of preventing mother-to-child transmission (if the infected mother-to-be is receiving the adequate treatment) might have a significant impact.

## *1.6 Conclusion*

HIV has become a pandemic since its appearance in the 1980s, causing millions of deaths. Due to the human and economic tragedy associated with the disease, it has become extremely important to design appropriate policies such as informational campaigns in order to deter the spread of the epidemic. For that, an important issue is to identify where people seek information about HIV. This paper investigates the formation of informal HIV conversational networks in rural Malawi. Using data from the Malawi Longitudional

Study of Families and Health, that contains detailed data on conversational networks, we compare individual choices of conversational partners between the networks created to discuss family planning and the one to discuss HIV-related issues. If networks were constructed randomly, there should be limited differences in the composition of different networks for the same individual, as establishing a link is costly.

Results show that both men and women are strategic in network formation, specifically targeting individuals who are perceived to provide them with better information. However, the characteristics that they use to infer the access to information from their partners are different. Women who have a low likelihood of being infected increase the probability of choosing a partner with a higher education by 12.4 p.p. Men who perceive themselves not to be infected (or have a low likelihood of infection) increase the probability of establishing a link by 18.6 p.p. if the potential partner listens to news and information slots on the radio. Overall we have that people who believe themselves not to be infected seek information from more qualified partners in order to maintain their HIV- status. This difference between behaviors according to the perceived likelihood of infection could also indicate a fatalistic behavior from those who believe themselves to be infected. Policy makers should not only promote campaigns that provide people incentives to protect themselves from the disease, but should also seek to instil infected people with an altruistic behavior, providing them with information on how to protect others which could potentially decrease the spread of the disease.

In conclusion, we find that people target specific individuals when forming conversational networks in order to access information. This finding provides valuable guidelines to mass media campaigns. Information campaigns do not substitute for social networks, as people look to their peers for information, especially for new and qualified information. Taking this complementarity into account, campaigns should focus on identifying the key players, i.e., those who are sought out by the ones seeking information, in each network, and target those individuals. As individuals strategically seek information in

their network, this will improve the efficiency of the message in a two-fold way: on the one hand, it is a way of passing the information at stake to the social network level. On the other hand, as it targets only specific individuals it allows for a reduction in the costs of such mass-media campaigns.

# BIBLIOGRAPHY


Bala, B. and Goyal, S. (1999). A non-cooperative theory of network formation. *Tinbergen Institute Discussion Papers*, **25** (1), Tinbergen Institute.

Behrman, J. R., Kohler, H.-P. and Watkins, S. C. (2002). Social networks and changes in contraceptive use over time: Evidence from a longitudinal study in rural Kenya. *Demography*, **39** (4), 713–738.

Bignami Van-Assche, S., Reniers, G. and Weinreb, A. (2003). An assessment of the KDICP and MDICP data quality: Interviewer effects, question reliability and sample attrition. *Demographic Research*, **1** (2), 31–76.

Brock, W. and Durlauf, S. N. (2001). *Interactions-Based Models*, Elvesier Science, chap. 54, pp. 3297–3380.

CIA (2011). *World Fact Book*. Tech. rep., CIA.

Conley, T. and Udry, C. (2001). Social learning through networks: The adoption of new agricultural technologies in Ghana. *American Journal of Agricultural Economics*, **83** (3), 668–73.

Cubitt, R. and Sugden, R. (1998). The selection of preferences through imitation. *Review of Economic Studies*, **65**, 761–771.

Fafchamps, M. and Gubert, F. (2007). Risk sharing and network formation. *Journal of Development Economics*, **83** (2), 326–350.

Gerland, P. (2004). *Paper presented at the Annual Meeting of the Population Association of America*. u in, PAA.

Helleringer, S. and Kohler, H.-P. (2005). Social networks, perceptions of risk and changing attitudes towards HIV/AIDS: New evidence from a longitudinal study using fixed-effects estimation. *Population Studies*, **59** (3), 265–282.

Holden, R. (1987). Time series analysis of a contagious process. *American Statistical Association*, **82** (400), 1019–1026.

Jackson, A. (1972). A model for determining information diffusion in a family planning program. *Journal of Marriage and the Family*, **34** (3), 503–513.

Kohler, H.-P. (1997). Learning in social networks and contraceptive choice. *Demography*, **34** (3), 369–381.

—, Behrman, J. R. and Watkins, S. C. (2007). Social networks and HIV/AIDS risk perceptions. *Demography*, **44** (1), 1–33.

Lancaster, T. (2000). The incidental parameter problem since 1948. *Journal of Econometrics*, **95**, 391–413.

Manski, C. (1993). Identification of endogenous social effects: The reflection problem. *The Review of Economic Studies*, **60** (3), 531–542.

McPherson, M., Smith-Lovin, L. and Cook, J. M. (2001). Birts of a feather: Homophily in social networks. *Annual Review of Sociology*, **27**, 414–444.

Montgomery, M., Kiros, G.-E., Agyeman, D., Casterline, J., Aglobitse, P. and Hewett, P. (2001). Social networks and contraceptive dynamics in Southern Ghana. *Policy Research Division Working Paper*, **153**, Population Council, New York.

Neyman, J. and Scott, E. (1948). Consistent estimation from partially consistent observations. *Econometrica*, **16**, 132.

Rosero-Bixby, L. and Casterline, J. (1993). Modelling diffusion effects in fertility transition. *Population Studies*, **47** (1), 147–167.

Schatz, E. (2002). *Paper Presented at the Annual Meeting of the Population Association of America, Atlanta, USA*. u in.

UNAIDS (). *Report on the Global AIDS Epidemic*. Tech. rep.

UNGASS (2010). *Country Progress Report : Malawi HIV and AIDS Monitoring and Evaluation Report: 2008-2009*. Tech. rep., UNGASS.

Wasserman, S. and Faust, K. (1994). *Social Network Analysis: Methods and Applications*. Press Sindicate of the University of Cambridge.

Zulu, E. and Chepngeno, G. (2003). Spousal communication about the risk of contracting HIV/AIDS in rural malawi. *Demographic Research*, **1**, 247278.

*Tab. 1.1:* Descriptive Statistics

| | Men | Women | Total |
|---|---|---|---|
| **Education Level** | | | |
| No schooling | 18 | 33.6 | 27.6 |
| Primary Schooling | 69 | 60.1 | 63.5 |
| Secondary Schooling | 13 | 6.3 | 8.9 |
| **Marital Status** | | | |
| Married | 97.24 | 90.51 | 93.11 |
| Divorced | 0.41 | 1.03 | 0.79 |
| Separated | 1.43 | 5.06 | 3.66 |
| Widowed | 0.92 | 3.4 | 2.44 |
| **Age Categories** | | | |
| Less than 30 years | 13.6 | 33.7 | 24.7 |
| 30 - 40 years | 21.4 | 25.9 | 23.9 |
| 40 - 50 years | 15.8 | 16.4 | 16.1 |
| More than 50 years | 49.2 | 24.1 | 35.3 |
| **Earnings** | 133.66 | 57.25 | 91.25 |
| | (267.77) | (213.15) | (242) |
| **Number of Children** | 2.77 | 2.95 | 2.87 |
| | (3.12) | (2.47) | (2.78) |
| **Roof Material** | | | |
| Metal | 10.23 | 10.29 | 10.26 |
| Thatch | 89.49 | 89.71 | 89.63 |
| Other | 0.28 | 0.0 | 0.11 |
| **Perceived Likelihood of Infection** | | | |
| No Likelihood | 72.1 | 61.2 | 65.6 |
| Low Likelihood | 17.4 | 21.3 | 19.7 |
| Medium Likelihood | 6.1 | 7.3 | 6.8 |
| High Likelihood | 4.4 | 10.2 | 7.8 |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 1.2:* Social Network Composition

| | FP Network | | | AIDS Network | | |
|---|---|---|---|---|---|---|
| | Men | Women | Total | Men | Women | Total |
| **Number of NWP** | 5.78 | 5.39 | 5.54 | 7.23 | 5.7 | 6.29 |
| | (5.9) | (5.64) | (5.74) | (7.26) | (5.42) | (6.24) |
| **Density** | 0.9 | 0.91 | 0.9 | 0.94 | 0.94 | 0.94 |
| | (0.23) | (0.21) | (0.22) | (0.15) | (0.17) | (0.17) |
| **Gender NWP** | | | | | | |
| Male | 85.6 | 1.9 | 34 | 94.7 | 6.7 | 41.6 |
| Female | 14.4 | 98.1 | 66 | 5.3 | 93.3 | 58.4 |
| **Education NWP** | | | | | | |
| No Education | 20.1 | 33.1 | 28 | 18.1 | 32.3 | 26.6 |
| Primary Education | 63 | 59.5 | 60.9 | 63.4 | 57.5 | 59.9 |
| Secondary Educ. or Higher | 16.9 | 7.4 | 11.1 | 18.4 | 10.2 | 13.5 |
| **Strength Relation NWP** | | | | | | |
| Confidant | 31.2 | 27.6 | 29 | 19.5 | 17.7 | 18.4 |
| Just Friend | 56.1 | 59.1 | 58 | 64.7 | 65.2 | 65 |
| Just Acquaintance | 11.5 | 11.8 | 11.7 | 14.4 | 14.3 | 14.4 |
| Met once or twice | 1.3 | 1.4 | 1.4 | 1.4 | 2.8 | 2.3 |
| **NWP listens Info on Radio** | 95 | 94.9 | 94.9 | 96.8 | 95.4 | 96 |
| **NWP is Trained** | 1.9 | 1.2 | 1.5 | 0.6 | 1.8 | 1.3 |
| **NWP has Higher Education** | 19.81 | 18.66 | 19.11 | 20.2 | 19.39 | 19.72 |

NWP = Network Partner
Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 1.3:* Differences between Networks

| | Men | | Women | |
|---|---|---|---|---|
| | Difference | T-test | Difference | T-Test |
| **Number of NWP** | -1.45 | -9.68*** | -0.31 | -3.12*** |
| **Density** | -0.05 | -10.29*** | -0.03 | -8.61*** |
| **Women NWP** | -0.09 | -11.16*** | -0.05 | -11.70*** |
| **Location NWP** | | | | |
| Same HH | -0.01 | -4.26*** | -0.008 | -3.65*** |
| Same Compound | 0.01 | 1.83* | 0.04 | 4.82*** |
| Same Village | 0.06 | 4.60*** | 0.07 | 6.54*** |
| Same TA | -0.07 | -4.50*** | -0.09 | -9.10*** |
| Same District | -0.01 | -1.34 | -0.004 | -1.23 |
| Elsewhere | 0.004 | 0.94 | -0.005 | -1.44 |
| **Relation NWP** | | | | |
| Friend | -0.08 | -5.88*** | -0.01 | -0.58 |
| Own Relative | 0.004 | 0.46 | -0.01 | -1.05 |
| In Law Relative | 0.04 | 5.34*** | 0.05 | 5.40*** |
| Other Relative | 0.04 | 3.86*** | -0.01 | -0.78 |
| Acquaintance | -0.01 | -1.42 | -0.02 | -2.79*** |
| Other | 0.01 | 2.14** | -0.01 | -2.54** |
| **Education NWP** | | | | |
| No Education | 0.02 | 1.82* | 0.01 | 0.77 |
| Primary Education | -0.004 | -0.32 | 0.02 | 1.87* |
| Secondary Educ. or Higher | -0.02 | -1.48 | -0.03 | -4.58*** |
| **Strength Relation NWP** | | | | |
| Confidant | 0.28 | 0.18 | 0.09 | 10.95*** |
| Just Friend | 0.59 | 0.65 | -0.06 | -5.78*** |
| Just Acquaintance | 0.12 | 0.14 | -0.03 | -3.52*** |
| Met once or twice | 0.01 | 0.03 | -0.01 | -4.67*** |
| **NWP has a Higher Education** | -0.004 | -0.36 | -0.007 | -0.83 |
| **NWP listens Info on Radio** | -0.02 | -3.86*** | -0.004 | -1.17 |
| **NWP is Trained** | 0.01 | 4.04*** | -0.005 | -2.07** |

NWP = Network Partner
* significant at 10%; ** significant at 5%; *** significant at 1%

*Tab. 1.4:* Social Distance

| | FP Network | | | AIDS Network | | |
|---|---|---|---|---|---|---|
| | Men | Women | Total | Men | Women | Total |
| **Same Gender** | 85.59 | 98.08 | 93.29 | 94.73 | 93.25 | 93.84 |
| **Religiosity** | | | | | | |
| Both made Tauba / Born Again | 8.48 | 4.01 | 5.71 | N/A | N/A | N/A |
| Only Resp. made Tauba / Born Again | 10.36 | 7.20 | 8.41 | N/A | N/A | N/A |
| Only NWP made Tauba / Born Again | 3.76 | 3.62 | 3.67 | N/A | N/A | N/A |
| None made Tauba / Born Again | 77.39 | 85.17 | 82.21 | N/A | N/A | N/A |
| **Location NWP** | | | | | | |
| Same HH | 0.12 | 0.84 | 0.56 | 0.87 | 1.69 | 1.36 |
| Same Compound | 9.03 | 15.57 | 13.06 | 7.67 | 11.97 | 10.27 |
| Same Village | 47.23 | 53.21 | 50.92 | 41.11 | 46.2 | 44.19 |
| Same TA | 37.09 | 24.99 | 29.63 | 43.64 | 33.8 | 37.7 |
| Same District | 3.01 | 2.92 | 2.95 | 3.65 | 3.37 | 3.48 |
| Elsewhere | 3.52 | 2.47 | 2.87 | 3.07 | 2.97 | 3.01 |
| **Relation NWP** | | | | | | |
| Friend | 45.7 | 42.5 | 43.7 | 53.5 | 43.1 | 47.2 |
| Own Relative | 13 | 12.1 | 12.4 | 12.6 | 12.8 | 12.7 |
| In Law Relative | 11.7 | 21.5 | 17.7 | 7.5 | 17 | 13.2 |
| Other Relative | 15.6 | 11.6 | 13.1 | 12 | 12.2 | 12.1 |
| Acquaintance | 11.5 | 10.2 | 10.7 | 12.7 | 12 | 12.3 |
| Other | 2.6 | 2.1 | 2.3 | 1.7 | 2.9 | 2.4 |

The degree of religiosity proportions were computed using the sub-sample where the data for tauba/born again were available for both the respondent and the network partner.
NWP = Network Partner

*Tab. 1.5:* Network Selectivity

**Dependent Variable: FP Network partner chosen to be part of AIDS Network**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Information Value** | | | | | | |
| Relative Density | 1.78*** | 1.49*** | 1.68*** | 1.58*** | 1.70*** | 1.57*** |
| | (0.25) | (0.25) | (0.24) | (0.24) | (0.24) | (0.24) |
| Relative Density Square | -2.92*** | -2.63*** | -2.81*** | -2.71*** | -2.83*** | -2.71*** |
| | (0.29) | (0.28) | (0.27) | (0.26) | (0.28) | (0.26) |
| NWP Higher Educ | 0.01 | -0.01 | | | | |
| | (0.02) | (0.02) | | | | |
| NWP Higher Educ * | -0.07 | -0.12* | | | | |
| Lik Infec | (0.08) | (0.07) | | | | |
| NWP Radio | | | 0.07** | -0.00 | | |
| | | | (0.04) | (0.03) | | |
| NWP Radio * | | | -0.19* | 0.02 | | |
| Lik Infec | | | (0.11) | (0.08) | | |
| NWP Trained | | | | | 0.09 | -0.09 |
| | | | | | (0.07) | (0.13) |
| NWP Trained * | | | | | -0.06 | 0.14 |
| Lik Infec | | | | | (0.08) | (0.29) |
| **Social Distance** | | | | | | |
| Same Gender | 0.26*** | -0.00 | 0.25*** | -0.00 | 0.25*** | -0.00 |
| | (0.04) | (0.00) | (0.04) | (0.00) | (0.04) | (0.00) |
| Both Tauba | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| | (0.03) | (0.02) | (0.03) | (0.02) | (0.03) | (0.02) |
| Same HH | -0.23*** | 0.24*** | -0.21*** | 0.24*** | -0.21*** | 0.23*** |
| | (0.07) | (0.09) | (0.06) | (0.09) | (0.06) | (0.08) |
| Same Compound | -0.03 | 0.12** | -0.04 | 0.12** | -0.03 | 0.12** |
| | (0.05) | (0.05) | (0.04) | (0.05) | (0.04) | (0.05) |
| Same Village | 0.00 | 0.10** | 0.00 | 0.10** | 0.01 | 0.10** |
| | (0.04) | (0.05) | (0.04) | (0.04) | (0.04) | (0.04) |
| Same TA | 0.02 | 0.06 | 0.02 | 0.06 | 0.02 | 0.06 |
| | (0.04) | (0.05) | (0.04) | (0.04) | (0.04) | (0.04) |
| NWP Friend | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| NWP Own Relative | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.02 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| NWP In Law Relative | 0.00 | 0.03 | 0.00 | 0.03* | 0.01 | 0.03* |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Constant | 0.12 | 0.33*** | 0.09 | 0.29*** | 0.13* | 0.30*** |
| | (0.08) | (0.07) | (0.08) | (0.07) | (0.08) | (0.07) |
| Observations | 2398 | 3446 | 2485 | 3638 | 2497 | 3655 |

Individual Fixed Effects Included
Robust Standard Error in Parentheses, Clustered at the Individual Level.
* significant at 10%; ** significant at 5%; *** significant at 1%
NWP = Network Partner; FP = Family Planning

*Tab. 1.6:* Network Overlap

**Dependent Variable: Proportion of FP NWP chosen to be part of the AIDS Network**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Information Value** | | | | | | |
| Average Rel. Density | 1.10*** | 1.30*** | 1.09*** | 1.28*** | 1.08*** | 1.31*** |
| | (0.13) | (0.11) | (0.13) | (0.10) | (0.13) | (0.11) |
| Average Rel. Density | -1.34*** | -1.47*** | -1.32*** | -1.46*** | -1.32*** | -1.48*** |
| Square | (0.11) | (0.09) | (0.11) | (0.09) | (0.11) | (0.09) |
| Likelihood of Infect | -0.02 | 0.01 | -0.24 | 0.12** | -0.02 | 0.02 |
| | (0.02) | (0.01) | (0.17) | (0.06) | (0.02) | (0.01) |
| Prop NWP Higher Educ | -0.02 | 0.01 | | | | |
| | (0.03) | (0.02) | | | | |
| Lik Infec * | -0.00 | -0.01 | | | | |
| Prop NWP Higher Educ | (0.05) | (0.04) | | | | |
| Proportion NWP Radio | | | 0.05 | 0.11** | | |
| | | | (0.07) | (0.04) | | |
| Lik Infec * | | | 0.22 | -0.12* | | |
| Prop NWP Radio | | | (0.17) | (0.07) | | |
| Proportion NWP Trained | | | | | 0.01 | 0.08 |
| | | | | | (0.08) | (0.07) |
| Lik Infec * | | | | | -0.29 | -0.50* |
| Prop NWP Trained | | | | | (0.24) | (0.26) |
| **Social Distance** | | | | | | |
| Prop. NWP Same Gender | 0.02*** | 0.02*** | 0.02*** | 0.02*** | 0.02*** | 0.02*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Prop. NWP Same Tauba | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Prop. NWP Same HH | -0.36* | -0.07 | -0.35* | -0.07 | -0.35 | -0.07 |
| | (0.21) | (0.08) | (0.21) | (0.08) | (0.21) | (0.08) |
| Prop. NWP Same | 0.07*** | 0.08*** | 0.07*** | 0.08*** | 0.07*** | 0.08*** |
| Compound | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Prop. NWP Same | 0.05*** | 0.06*** | 0.04** | 0.06*** | 0.05*** | 0.06*** |
| Village | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Prop. NWP Friends | -0.02 | -0.00 | -0.02 | -0.00 | -0.02 | -0.00 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Prop. NWP Own | -0.05* | 0.01 | -0.06* | 0.01 | -0.05* | 0.01 |
| Relatives | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| Prop. NWP In Law | -0.00 | 0.06** | -0.00 | 0.05** | -0.00 | 0.05** |
| Relatives | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| Constant | -0.31*** | -0.36*** | -0.37*** | -0.45*** | -0.30*** | -0.35*** |
| | (0.09) | (0.07) | (0.10) | (0.08) | (0.09) | (0.07) |
| Observations | 753 | 1102 | 763 | 1117 | 763 | 1117 |

Robust Standard Error in Parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Regressions control for respondent characteristics: age, age squared, education, number of children, earnings, and house roof material

NWP = Network Partner; FP = Family Planning

## *1.A MLSFH Questionnaire*

### *Questions about the Family Planning Network*

*Now, I'd like to ask you about other people that you may have talked with about family planning. Women (men) often chat with each other about children and about ways to keep from having another birth. Now I would like to know about your chats with friends and relatives about modern methods of childspacing / family planning. Some of these people may approve of family planning, but some may not approve of it.*

- How many people have you chatted with about modern methods of childspacing / family planning? I mean people other than your husband (wife / wives) of partner?
  *Instructions for the interviewer: (1) Do not include husband / wife; (2) If less than four are named, probe: can you think of anyone else? How about sitting in on a conversation in which you did not speak?*

- Could you please give me the names of four of these? As I said earlier, this information will be completely confidential, it's just for our research.
  *Instructions for the interviewer: After you write the four names here, turn to the matrix on the back of the questionnaire and write all four names again, in the same order.*

- Is (...) male or female?

- What is your relationship to(...)?

- How close is (...) to you? Is he/she an acquaintance, just a friend, or a confidant

- Where does (...) stay?

- How much education has(...) had?

- What religion is(...)?

- *If partner is Moslem ask:* Has (...) made Tauba?

- *If partner is Christian ask:* Is (...) a Born Again
- *If partner is Moslem ask:* When did (...) make Tauba?
- *If partner is Christian ask:* When did (...) become Born Again?
- Has (...) ever done anything to try to space births or to stop childbearing altogether?
- Has (...) used a modern method, traditional method or both?
- *If partner is female ask:* Was there ever a time that her husband did not know that she used modern methods of childspacing / family planning?
- Is (...) still using any method of childspacing / family planning now?
- Is (...) using a modern or traditional method of childspacing or family planning?
- Has (...) ever mentioned to you that he/she heard a talk about modern family planning at the clinic/hospital or on the radio, or did he/she ever tell you that a CBD came to his/her home to give him/her information about family planning?

*Questions about the AIDS Network*

*Now, I'd like to ask you some questions about people you've chatted with about AIDS.*

- How many people have you chatted with about AIDS? I mean people other than your husband (wife / wives) or partner.
  *Instructions for the interviewer: (1) Do not include husband (wife); (2) If less than four are named, probe: can you think of anyone else? How about sitting in on a conversation, even if you yourself didn't say anything?*
- Could you please give me the names of four of these? As I said earlier this information will be completely confidential.
  *Instructions for the interviewer: after you write the four names here, turn to the matrix at the back of this questionnaire and write all four names.*

- What does (...) think is the best way to protect herself / himself from getting AIDS?
- Has (...) ever mentioned to you that he/she has heard a talk at the clinic/hospital about AIDS, or heard a radio program about AIDS, or that a CBD or an HSA came to his/her home to give him/her information about how people can protect themselves against AIDS?
- Is (...) one of the same people you told me you talked to about family planning? *Instructions to the interviewer: If yes, look at the matrix at the end and identify which family planning network partner this is. Then fill out the "same" as column making sure that the names are the same.*
- Is (...) male or female?
- What is your relationship to(...)?
- Where does (...) stay?
- How close is (...) to you? Is he / she an acquaintance, just a friend, or a confidant?
- How much education has (...) had?
- Has (...) ever used modern family planning?
- *If NWP is female / male, ask:* Is (...) the best friend than you talked to me about earlier?
- Do you think (...) had sexual partners other than his / her spouse or regular partner in the last year?
- How many partners do you think he / she had over the last year?
- Do you think (...) sometimes or always or never uses condoms with these other partners?
- How worried is (...) about getting AIDS?

- What does (...) think is the likelihood (chance) that he/she is infected with HIV/AIDS now?
- What does (...) think is the likelihood (chance) that he/she will become infected with AIDS in the future?

*Questions on the overlap between the Family Planning and the AIDS Networks*

*Finally, I would like briefly to ask you how well all the people you told me you chat with about both AIDS and family planning know each other.*

For each pair that I mention, please tell me whether they are confidants, just friends, acquaintances, or they do not know each other.

*Instructions for the interviewer: Ask whether the network partner recorded in rows and those recorded in columns know each other and how well they do so. Record the code in the corresponding cell.*

# 2. HIV-RELATED SOCIAL STIGMA AND RISKY SEXUAL BEHAVIOR IN A HIGH HIV PREVALENCE ENVIRONMENT

With Adeline Delavande and Neeraj Sood[1]

## *2.1 Introduction*

The HIV/AIDS epidemic is a global health problem that has led to the death of 25 million people (UNAIDS 2008). In Malawi, the setting of our study, the 2007 adult prevalence rate is 11%, accounting for 68,000 deaths annually and more than half a million orphans (Malawi Demographic and Health Survey MDHS-, 2010). In 1987, Jonathan Mann, founding Director of the World Health Organization (Mann (1987)) described the AIDS epidemic in three phases: In the first wave HIV infection develops silently within a community, not showing its consequences immediately. In the second wave the silent infection becomes an epidemic of HIV/AIDS that can occur shortly or within several years after the first phase. The third and last phase, described as the third epidemic, is the epidemic of social, cultural, economic, and political responses to AIDS. This phase is characterized by high levels of stigma and discrimination that *are as central to the global AIDS challenge as the disease itself* (Mann (1987)). Similarly, a report from UNAIDS (2007) states that *"stigma associated with HIV and the resulting discrimination can be as devastating as the illness itself: abandonment by spouse and/or family, social ostracism, job and poverty loss, school expulsion, denial of medical services, lack of care and support, and violence."* In response to these concerns, UNAIDS and others have recommended

[1] We thank Andrew Francis, Hugo Mialon, Susan Watkins, and seminar participants at Nova School of Business and Economics, the University of Quebec at Montreal, the 2010 Jamboree in Alicante for comments. Delavande gratefully acknowledges support for this research through the National Institute of Child Health and Development (grant number R03HD058976) and a NOVA Forum research grant. Sood gratefully acknowledges support for this research from the National Institute of Child Health and Development (grant number R01HD054877).

reducing the amount of stigma and most countries state that fighting stigma is part of their national HIV strategy (UNAIDS (2008a); UNAIDS (2008b)).

A considerable body of literature evaluates the association between social stigma against HIV on testing and treatment decisions. Adeneye *et al.* (2006) reports that women in Nigeria who were unwilling to be tested cited strong fears of stigma if they tested HIV+. Similarly, a Vietnam-based study stated that stigma and discrimination were important reasons for refusal among the 60% of pregnant women who were unwilling to be tested[2] (Thu Anh *et al.* (2008)). Social stigma is not only an important reason for unwillingness to be tested, it is also an important predictor of the non-utilization of Voluntary Counseling and Testing (VCT) services (Wolfe *et al.* (2006), Bwambale *et al.* (2008), Khumalo-Sakutukwa *et al.* (2008) .

Social stigma is also associated with the demand for HIV treatment, determining its uptake and adherence. While the effect on the uptake of such therapies is unclear, being mediated by gender effects (Nyirenda *et al.* (2006)), the evidence supporting the link between stigma and adherence is much stronger. For example, Wolitski *et al.* (2009) found that perceived external stigma is strongly associated with non-adherence to HIV treatment. A recent literature survey conducted by UNAIDS also reports that there is clear evidence that stigma and discrimination increase obstacles to adherence and maintenance in anti-retroviral therapy programs all over the world (UNAIDS (2008a)).

In addition to increasing disease burden, reducing testing, and reducing treatment adherence, social stigma might have important effects on HIV related risky behavior. Earlier work based on social representation theory and AIDS risk reduction models suggests that stigma might lead individuals to disassociate from the stigmatized group (Joffe (2002), Joffe (2003), Catania *et al.* (1994)). Societies with high stigma react to the disease by discriminating and marginalizing HIV+ individuals. As blame is attributed to a specific group, the majority feels safe from the source of infection, which can mitigate the

[2] As part of the data collection project we use, 91% of the respondents agreed to rapid testing.

adoption of unsafe sexual practices (Goodwin *et al.* (2004), Joffe (1999), Catania *et al.* (1994)). The effect of stigma on risky behavior might also extend to those who are HIV+; they may not disclose HIV status, may be more vindictive toward the general population, or may feel a lower sense of self-worth or value of life and thus increase risky behavior in response to higher stigma. Hence, increased (decreased) social stigma might make the general population more (less) prone to risky behavior.

On the other hand, from the perspective of a simple economic model, stigma can be viewed as a social tax on risky HIV related behavior. As with other taxes, reducing this social tax will increase the activity that is being taxed. Thus, in the context of HIV, the effect of reducing stigma could be increased risky behavior, as the price or cost of being HIV+ will decrease. Therefore, the likely effect of a change in social stigma on risky sexual behavior is *a priori* ambiguous, as different theories predict opposing effects. Ultimately this is an empirical question.

Some prior empirical research based on data from the US sheds light on this issue. Francis and Mialon (2010) investigated the effect of tolerance toward gays on the spread of HIV. They conclude that a 20 percentage point rise in tolerance (which corresponds to the increase in tolerance from 1990 to today) is associated with a reduction in the HIV rate of about one case per 100,000 inhabitants and a decrease in the number of heterosexual HIV cases by about 0.3 per 100,000 inhabitants. This link may be a result of increased tolerance inducing gay men to substitute away from underground, risky behavior, and/or easing the entry of low-risk men to the pool of homosexual partners. In a different study, Preston *et al.* (2007) explored the effects of stigma on sexual risk behavior among rural men having sex with men. By hypothesizing that stigma would indirectly affect sexual risk behavior through their mental health status, specifically self-esteem and internalized homophobia, they found that an increase in stigma was mediated by these mental health variables, increasing risk behavior. Also, Francis *et al.* (2011) find a modest positive association between same-sex marriage bans, which could either influence or

reflect intolerance toward gay, and syphilis, a proxy for risky homosexual behavior (since the majority of syphilis cases are attributable to men who have sex with men).
In related work, Delavande *et al.* (2010) analyze the effects of criminal prosecution in the US of HIV+ persons who expose others to the risk of infection. The authors find that increasing the rate of prosecution has two competing effects on the spread of HIV. On the one hand, increased prosecution is associated with a reduction in the number of partners and increased frequency of safe sex practices such as condom use. On the other hand, increased prosecution is associated with sex with more promiscuous partners, such as prostitutes, where the tracing of the infection source is less likely. They find that the former effect dominates and doubling the rates of prosecution could reduce the cumulative number of infections by a third over a ten year period.

All the empirical analyses discussed above are US based and to our knowledge no research has addressed or estimated the effects of stigma on risky sexual behavior in a developing country context with high HIV prevalence. In this paper, we investigate whether these effects persist in the context of social prosecution of HIV in rural Malawi. We estimate the causal effect of village-level stigma on individual risky sexual behavior by using plausibly exogenous variation in stigma arising from the introduction of a radio campaign implemented to reduce social stigma against people living with HIV/AIDS. We find that a decrease in social stigma in one's village is associated with fewer sexual partners and a lower likelihood of having extra-marital relations. These findings are consistent with earlier theoretical models from social representation theory as well as empirical estimates from the US on the effects of tolerance toward gays on the spread of HIV.

## 2.2 Data

### 2.2.1 The Malawi Longitudinal Study of Families and Health

The data we use in this paper come from the 2004 and 2006 waves of the Malawi Longitudional Study of Families and Health (MLSFH, formerly Malawi Diffusion and Ideational Change Project, MDICP). The MLSFH is a longitudinal panel of data started in 1998, conducted in 145 villages of three regions of rural Malawi: Balaka (South), Mchinji (Central) and Rumphi (North)[3]. Approximately 25% of all households in each village were randomly selected to participate in 1998, and ever-married women and their husbands from these households were interviewed in 1998, 2001, and 2004. In 2004, a sample of about 400 adolescents aged from 14-28 residing in the MLSFH villages was added to the original sample. Comparisons with the Malawi Demographic and Health Survey showed that the MLSFH sample population is reasonably representative of the rural Malawi population (Anglewicz *et al.* (2009)). HIV prevalence in the sample was 6.4% in 2004 and 7.4% in 2006.

Overall, 3,622 respondents were interviewed in 2004, and 84.36% of those were re-interviewed in 2006. Anglewicz *et al.* (2009) show that attrition between 2004 and 2006 is not related with expectations of HIV risk, the number of conversational network partners, the number of sexual partners, and whether the respondent has ever used contraceptive methods.

### 2.2.2 Measures of Social Stigma against People Living with AIDS

The MLSFH asks two questions of special interest that elicit the respondents attitudes toward people living with AIDS, and their perception of stigma against people living with AIDS in their community. In particular:

[3] Detailed descriptions of the MLSFH sample selection, data collection, and data quality are provided on the project website http://www.malawi.pop.upenn.edu/, in a Special Collection of the online journal Demographic Research that is devoted to the MLSFH (Watkins *et al.* (2003)), and in a recent working paper that incorporates the 2004 and 2006 MLSFH data (Anglewicz *et al.* (2009)).

- If a female teacher has the AIDS virus but is not sick, should she be allowed to keep teaching school? Yes/No

- Would you buy fresh vegetables from a vendor who has the AIDS virus? Yes/No

Both questions capture social, economic, and labor discrimination created by social stigma against people living with AIDS[4].

We are interested in evaluating the impact of the community level of stigma against people living with HIV/AIDS on individual behavior. Therefore, we construct village-level measures of stigma by computing (i) the proportion of people in each village reporting that a teacher with AIDS should not be allowed to teach, and (ii) the proportion of people that would not buy vegetables if the vendor had AIDS. Both variables were constructed such that an increase in the variable represents an increase in the social stigma at the village level. To capture these different measures of stigma in a single variable, we construct a Stigma Index. This Index is a weighted average of the two stigma variables described above, whose weights were obtained through a principal component analysis. A higher level of Stigma Index reflects a higher level of stigma at the village level.

### *2.2.3 Measures of Risky Behavior*

The level of social stigma in one's environment is likely to affect the sexual behavior of individuals along several dimensions. Below we list the measure of sexual activity used in this study that come from respondents' self-report:

- *Number of partners in the last 12 months.* This variable represents the number of partners in the last 12 months defined as 0, 1, 2, or 3 partners and more.

- *Extra-marital relations.* This binary variable equals 1 if a married respondent reports more than one sexual partner in the last 12 months. Respondents whose

[4] In 2006, respondents were asked a slightly different question for question (1): If a female teacher has the AIDS virus, should she be allowed to continue teaching in the school? with three possible answers 1. Can Continue; 2. Unsure, depends on the specific cause; 3. Should not continue. Respondents who said Can continue were recoded as if saying yes to the 2004 question. Only 2.5% of the respondents said Unsure. Our results are very similar if we recode the Unsure as yes, or if we only use question (2).

current marriage lasted for less than one year are excluded.

- *Risky Sex Index.* This variable equals 1 if the respondent reports having at most one sexual partner in the last 12 months, 2 when the respondent reports having two or more sexual partners but with frequent condom use (answers always or almost every time with at least one of the sexual partners when asked about the frequency of the condom use), and 3 when the respondent has at least two sexual partners in the last 12 months and does not report a frequent use of condom. This takes into account not only the number of sexual partners but also the riskiness of sexual encounters. It reflects the fact that respondents know they can avoid HIV transmission by reducing the number of partners and/or using condom.

- *Safe Sex* This variable equals 1 if the respondent reports having at most one partner in the last 12 months (with or without condom use) or having multiple partners with whom a condom was used.

- *Multiple Partners.* This variable equals 1 if the respondent reports having more than one partner in the last 12 months.

### *2.2.4 Analytical Sample*

The key independent variable of interest is the village level of stigma against people living with HIV/AIDS. In order to limit measurement error in the average Stigma Index variable, we restrict our analysis to respondents who live in a village having more than 30 sampled respondents. Our analytical sample uses respondents with non-missing covariates: 1,725 individuals in 2004 and 2,091 individuals in 2006.[5]

Table 2.1 shows descriptive statistics of the analytical sample. Most respondents are young (34 years old on average), married (78%), and have primary education (64%). In 2006, respondents were more likely to have one or no partner in the last 12 months (from 76% to 89 %), have safe sex, as defined above, (from 79% to 92%), and fewer extra-marital

[5] Because education is missing for almost 10% of the sample in 2004 (see Table 1), we keep individuals with missing education in our analytical sample and add a dummy for missing education in all regressions.

relations (from 25% to 13%).

Table 2.1 also shows average village characteristics for the 60 villages where respondents of the analytical sample reside. Note that stigma decreased between 2004 and 2006. For example, the average proportion of people who would not buy vegetables or fresh fruit from a vendor who has AIDS decreases from 24% to 8%. The other village-level characteristics were essentially unchanging between 2004 and 2006. Interestingly, the region-level stigma is the greatest in the highest HIV-prevalence region (not shown in Table 2.1).

## *2.3 Empirical framework and Identification*

We use a panel data model to investigate whether changes in social stigma in an individuals village level influences HIV related risky behavior. In particular we estimate the following equation:

$$Y_{it} = \alpha\overline{S_{v_it}} + X_{it}\beta + \overline{X_{v_i06}}\theta + \mu_v + \delta t + \epsilon_{it}$$

where $Y_{it}$ is the sexual behavior of individual $i$ at time $t$, $\overline{S_{v_it}}$ is the average social stigma in the village $v_i$ where respondent $i$ lives at time $t$, $X_{it}$ is a vector of individual $is$ characteristics at time $t$ (such as age, education, marital status, spending, and number of children), $\overline{X_{v_i06}}$ is the village characteristics vector interacted with an indicator variable for the year 2006, $\mu_t$ is a village fixed effect term, $t$ is an indicator for 2006, and $\epsilon_{it}$ is a random term. Standard errors are clustered at the village level.

Since our main explanatory variable (social stigma) is measured at the village level it is important to control for confounding factors that vary across villages. The model presented above controls for all time invariant village characteristics (village fixed effects). In addition, the model also allows for differential time trends based on observed village characteristics. In particular, the model allows for differential village-level trends in sexual behaviors by average household spending, average education, and average land ownership

at the village level.

However, it is still possible that changes in village-level stigma are correlated with unobserved village-level time trends such as changes in opinion of religious leaders and availability of anti-retroviral therapy, which may also influence changes in sexual activity. If this is the case, estimating the above equation by Ordinary Least Squares might lead to biased estimates.

To address this concern, we use an instrumental variables strategy, interacting the proportion of respondents in a village owning a radio with the year 2006 as the instrument for social stigma. The rationale behind our instrument is that a radio program targeting the reduction of social stigma was introduced after the 2004 interview. The Malawi Radio Diaries Program, carried out by the Malawi Bridge Project and initiated in November 2004, is a series of radio diaries that features true stories of HIV+ individuals on a weekly basis. HIV+ individuals narrate some of the daily problems they encounter (e.g., my daughter wants a pair of jeans but I cannot afford it) to highlight that people living with HIV/AIDS face problems similar to those facing the rest of the population. Importantly, the program contains no message regarding prevention of the disease, such as promoting safe sex or abstinence. It was broadcast by six different radio stations covering the whole national territory. As described in the FactSheet (2007)): "Diaries are personal, powerful accounts that engage the audience in the lives of the diarists, humanizing HIV and AIDS. The Radio Diaries are an innovative but practical way of affecting social norms and working to reduce stigma." This project has been demonstrated to be successful by significantly reducing stigma toward people living with HIV/AIDS (Rinal and Creel (2008)).

According to the 2004 MDHS, radio is the main source of information diffusion in rural Malawi, where 58.5% of the households own a radio (against 2.2% of television ownership). In the 2004 MDHS, 63.7% of rural women and 83.1% of rural men reported listening to radio at least once per week, and 65% of rural women and 80% of rural men

had heard a family planning message on the radio in the months prior to the survey. Note that exposure to radio is higher than radio ownership, suggesting that even individuals who do not own a radio have the opportunity to listen to it. In our analytical sample, about 89% of women and men report having heard some information about HIV/AIDS on the radio in the past month in 2004[6].

We hypothesize that the Radio Diaries Program had a stronger impact in villages where a higher proportion of residents owned a radio, since villagers would have been more likely to be exposed to the program. As such, the proportion of village residents who own a radio is likely to introduce exogenous variation in changes in social stigma between 2004 and 2006 without directly influencing changes in risky behavior.

To investigate the validity of this instrument, we test whether the proportion of residents who own a radio in a village is correlated with changes in the village-level social stigma. In Table 2.2, we present the estimates of a regression using the Social Stigma Index as dependent variable, and the proportion of population with radio as an independent variable, controlling also for a set of village-level variables. It shows that the effect of the proportion of people with radio on social stigma becomes greater after the implementation of the radio diaries program. In 2004, the coefficient associated with the proportion of village population with a radio is -0.009 and is not statistically significant. In 2006, the magnitude of the coefficient more than doubles in absolute value to -0.021 and becomes statistically significant at the 5% level. Overall, these results suggest that our proposed instrument is correlated with changes in social stigma within a village but is uncorrelated with social stigma prior to the introduction of the radio diaries program. It is also useful to evaluate the relationship between stigma and village level characteristics. As shown in 2.2 stigma is negatively associated with higher levels of education and the decrease in stigma is greater when the proportion of villagers with secondary schooling increases. Moreover, the determinants of stigma change slightly from 2004 to

[6] This question was not asked in 2006.

2006. In 2006, the higher the proportion of women and married respondents, the higher the stigma that was perceived in the village. We can also look at the characteristics of the villages according to radio ownership. If we separate the villages into three groups according to the proportion of people who own a radio, we find that (from the lowest tercile to the highest tercile) the proportion of individuals who own land is 68%, 67%, and 63% respectively, and the proportion of individuals with secondary schooling is 5%, 11%, and 24% respectively. Radio ownership at the village level is therefore positively associated with the proportion of individuals with secondary schooling.

## *2.4 Results*

As a first approach we estimate the Ordinary Least Squares (OLS) regressions, with measures of risky sexual behavior (the number of partners in the last 12 months, the risky sex index, safe sex, multiple partners, and having extra-marital relations) as the dependent variables, and the social stigma index as the key explanatory variable. Table 2.3 presents the results. We find that overall a lower social stigma is associated with a less risky behavior. The coefficient associated with social stigma is statistically significant at 5%, with the exception of the regression using safe sex as dependent variable, where it is non-significant.

Second, we use our instrumental variable approach to investigate the causal impact of village-level stigma against people living with HIV/AIDS on individual risky behavior. Tables 2.4 and 2.5 present the first and second stage results of the instrumental variable estimation, respectively. The first stage results show that radio ownership is a strong predictor of reduction in social stigma at the village level. However, the F-test for the significance of our instrumental variable is 7.86, lower than 10, which is the rule of thumb for strong instruments (Stock and Yogo (2002)). We therefore also present in Table 2.5 under the coefficients associated with Social Stigma, inferences based on the Andersen Rubin (AR) test which are robust to the problem of potentially weak instruments (Finlay and Magnusson (2009)). Table 5 shows that in villages with lower social stigma, individu-

als tend to adopt safer sex: they have fewer partners, are less likely to have extra-marital relations, have a lower risky sex index, and are more likely to have safe sex. According to the AR test results, the coefficient on social stigma is statistically significant in all regressions at 1%, except for the extra-marital specification, where the coefficient is statistically significant at the 10% level. The average decrease in the social stigma at the village level between 2004 and 2006 is associated with 0.022 fewer sexual partners in the last 12 months, a 1.3 percentage point reduction in the probability of having an extra-marital affair, a 1.5 percentage point reduction in the likelihood of having multiple partners, and a 1.3 percentage point increase in the probability of reporting safe sex. This suggests that social sanctions, unlike formal laws, do not have a deterrence effect on individuals' risky behavior. In fact, as suggested by social representation theories and AIDS reduction models, a reduction in social stigma increases the adoption of safe sexual behaviors.

When comparing results from the OLS specifications (Table 2.3) and the IV approach (Table 2.5), we see from the magnitude of the coefficients that OLS underestimates the impact of social stigma on behavior. This suggests that unobserved determinants of stigma are negatively correlated with risky sexual activity. For example, religious intolerance might simultaneously increase social stigma and deter risky sexual practices.

Earlier studies suggest that the effects of stigma may differ across men and women. Nyirenda *et al.* (2006) show that the use of ART services is influenced by stigma, which might be differently experienced by men and women. Studies from South Africa found that men internalize stigma more than women do, while research from Tanzania shows that women report facing more enacted stigma than men (UNAIDS (2008b)). Both older and younger women report increased violence when requesting condom use, accessing VCT facilities, refusing sex within or outside marriage, or for testing HIV+ (Amoakohene (2004), Duvvury and J.Knoess (2005),Gaillard *et al.* (2002) and Go *et al.* (2003)).

In light of the findings reported in this literature we also estimate separate models for men and women in order to allow for gender differences in response to social stigma. Tables 2.6 and 2.7 in the Appendix present the results for men and women, respectively. To save space, we present only the coefficients associated with social stigma, but the specification is identical to that of Table 2.5. We find that the sexual behavior of men as compared to women is more responsive to changes in social stigma. In fact, social stigma appears to have little or no effect on the sexual activity of women (Table 2.7). In Table 2.6, however, we see that the coefficient associated with social stigma for men is about twice as large compared with those in Table 2.5, and precisely estimated using the AR Weak Instrument test (with the exceptions of the specification for extra-marital relations). A possible explanation for this difference is that social stigma is more likely to manifest itself as increased violence toward women who practice unsafe or risky sex. Thus, men might find it easier to disassociate from this group and feel less worried about their own sexual practices. That is, in environments with high stigma, the blame for HIV is passed to high risk women rather than to men. Another potential explanation may be that men, because they listen to the radio more often, have been more exposed to the Radio Diaries Program. This increased contact with the program may result in a higher perceived decrease of stigma for men, leading to a larger change in their risky sexual behavior. To better understand the mechanisms behind our empirical effect, it would be useful to distinguish whether stigma has a differential effect on HIV+ and HIV- individuals. However, our sample of HIV+ is too small to conduct separate analyses.

## *2.5 Conclusion*

In this paper we investigate the effects of social stigma against HIV+ persons on risky sexual behavior. We argue that the effects of social stigma on risky sexual behavior are *a priori* ambiguous. Social representation theories suggest that, when faced with social stigma, people disassociate from the risky group and engage in unprotected behaviors. On the other hand, from an economic perspective, stigma can be viewed as a social tax on risky behavior, and thus an increase in stigma would deter risky behavior. We use

plausibly exogenous variation in stigma arising from a Radio Diaries Program to estimate the effects of stigma on risky sexual behavior in rural Malawi. We find that reduction in stigma at the village-level is associated with a reduction in individual HIV- related risky behavior.

Overall, these results have important policy implications for combating the HIV/AIDS epidemic. First, our findings show that reducing social stigma can not only reduce the burden of disease for the HIV+ but can also promote safe or less risky sex, especially among men, and therefore it has the potential for reducing the number of new infections. Second, our results also suggest that social stigma against HIV+ persons can be changed through innovative interventions that use mass media rather than individual counseling for behavior or attitude change. Juxtaposing these implications suggests that reducing social stigma might be an important tool for reducing the burden of HIV and limiting the spread of HIV/AIDS in developing countries.

# BIBLIOGRAPHY


Adeneye, A., Brieger, W., Mafe, M., Adeneye, A., Salami, K., Titiloye, M., Adewole, T. and Agomo, P. (2006). Willingness to seek HIV testing and counseling among pregnant women attending antenatal clinics in Ogun state, Nigeria. *International Quarterly of Community Health Education*, **26** (4), 337–353.

Amoakohene, M. (2004). Violence against women in Ghana: a look at womens perceptions and review of policy and social responses. *Social Science & Medicine*, **59** (11), 2373–2385.

Anglewicz, P., Adams, J., Obare, F., Kohler, H.-P. and Watkins, S. (2009). The Malawi Diffusion and Ideational Change Project 2004-06: Data collection, data quality, and analysis of attrition. *Demographic Research*, **20** (21), 503.540.

Bwambale, F., Ssali, S., Byaruhanga, S., Kalyango, J. and Karamagi, C. (2008). Voluntary HIV counselling and testing among men in rural western Uganda: Implications for HIV prevention. *BMC Public Health*, **8**, 263.

Catania, J., Coates, T. J. and Kegeles, S. (1994). A test of the AIDS risk reduction model: Psychosocial correlates of condom use in the AMEN cohort survey. *Health Psychology*, **13** (6), 548–555.

Delavande, A., Sood, N. and Goldman, D. (2010). Criminal prosecution and HIV-related risky behavior. *Journal of Law and Economics*, **53** (4), 741–782.

Duvvury, N. and J.Knoess (2005). Gender based violence and HIV/AIDS in cambodia: Links, opportunities and potential responses. *Deutsche Gesellshaft fur Technische Zusammernarbeit*.

FactSheet, R. D. (2007). Bridge project (2007).

Finlay, K. and Magnusson, L. M. (2009). Implementing weak instrument robust tests for a general class of instrumental variables models. *Tulane University Working Paper*, **0901**.

Francis, A. M., Mialon, H. H. M. and Handie, P. (2011). In sickness and in health: Same-sex marriage laws and sexually transmitted infections. *Emory Law and Economics Research Paper*, **11-97**.

— and Mialon, H. M. (2010). Tolerance and hiv. *Journal of Health Economics*, **39** (2), 250–267.

Gaillard, P., Melis, R., Mwanyumba, F., Claeys, P., Muigai, E., Mandaliya, K., Bwayo, J. and Temmerman, M. (2002). Vulnerability of women in an african setting: Lessons for mother-to-child transmission prevention programmes. *AIDS*, **16** (6), 937–939.

Go, V., Johnson, C., Bentley, M., Sivaram, S., Srikrishnan, A., Solomon, S. and Celentano, D. D. (2003). When HIV-prevention messages and gender norms clash: The impact of domestic violence on womens HIV risk in Slums of Chennai, India. *AIDS and Behavior*, **7** (3).

Goodwin, R., Kozlova, A., Nizharadze, G. and G.Polyakova. (2004). HIV/AIDS among adolescents in Eastern Europe: Knowledge of HIV/AIDS, social representations of risk and sexual activity among school children and homeless adolescents in Russia, Georgia and the Ukraine. *Journal of Health Psychology*, **9** (3), 381–396.

Joffe, H. (1999). *Risk and "the other*. Cambridge University Press.

— (2002). Social representations and health psychology. *Social Science Information*, **41**, 559–580.

— (2003). Risk: from perception to social representation. *British Journal of Social Psychology*, **42**, 55–73.

Khumalo-Sakutukwa, G., Morin, S., Fritz, K., Charlebois, E., Rooeyn, H. v., Chingono, A., Modiba, P., Mrumbi, K., Visrutaratna, S., Singh, B., Sweat, M., Celentano, D. and Coates, T. (2008). Project accept: a community-based intervention to reduce hiv incidence of populations at risk for HIV in sub-Saharan Africa and Thailand. *Journal of AIDS*, **49** (4), 422–431.

Mann, J. (1987). *Statement at an informal briefing on AIDS to the 42nd session of the United Nations General Assembly*. Tech. rep., New York.

Nyirenda, L., Makwiza, I., Bongololo, G. and Theobald, S. (2006). A gender perspective on HIV Treatment in Malawi: A multi-method approach. *Gender and Development*, **14** (1), 69–79.

Preston, D., DAugelli, A., Kassab, C. and Starks, M. (2007). The relationship of stigma to the sexual risk behavior of rural men who have sex with men. *AIDS Education & Prevention*, **19** (3), 218–230.

Rinal, R. and Creel, A. (2008). Applying social marketing principles to understand the effects of the radio diaries program in reducing HIV/AIDS Stigma in Malawi. *Health Marketing Quarterly*, **25** (1/2), 119–146.

Stock, J. and Yogo, M. (2002). Testing for weak instruments in linear IV regression. *NBER Technical Working Papers*, **0284**.

Thu Anh, N., Oosterhoff, P., Yem Pham, N., Wright, P. and Hardon, A. (2008). Barriers to access prevention of mother-to-child transmission for HIV positive women in well-resourced setting in Vietnam. *AIDS Research & Therapy*, **5**, 1–12.

UNAIDS (2008a). *HIV-related stigma and discrimination: A summary of recent literature*. Tech. rep., UNAIDS.

— (2008b). *Report on the global AIDS epidemic*. Tech. rep., UNAIDS.

Watkins, S., Behrman, J., Kohler, H.-P. and Zulu, E. (2003). Introduction to

research on demographic aspects of HIV/AIDS in rural Africa. *Demographic Research*, **1** (1), 1–30.

Wolfe, W., Weiser, S., Bangsberg, D., Thior, I., Makhema, J., Dickinson, D., Mompati, K. and Marlink, R. (2006). Effects of HIV-related stigma among an early sample of patients receiving antiretroviral therapy in Botswana. *AIDS Care*, **18**, 931–933.

Wolitski, R., Pals, S., Kidder, D., Quirk, C.-. and Holtgrave, D. R. (2009). The effects of HIV stigma on health, disclosure of HIV status, and risk behavior of homeless and unstably housed persons living with HIV. *AIDS Behavior*, **13** (6), 1222–1232.

Tab. 2.1: Descriptive Statistics

| | Descriptive Statistics | | |
|---|---|---|---|
| **Respondent Characteristics** | **2004** | **2006** | **Total** |
| Gender | | | |
| Men | 51.3 | 43.47 | 47.01 |
| Women | 48.7 | 56.53 | 52.99 |
| Marital Status | | | |
| Married / Living Together | 77.86 | 78.91 | 78.43 |
| Divorced /Separated/ Widowed | 2.9 | 7.84 | 5.61 |
| Never Married | 19.25 | 13.25 | 15.96 |
| Education Level | | | |
| No School | 15.13 | 25.25 | 20.68 |
| Primary School | 63.48 | 59.83 | 61.48 |
| Secondary School or Higher | 11.83 | 14.83 | 13.47 |
| Missing | 9.57 | 0.1 | 4.38 |
| Age Categories | | | |
| Less than 20 | 18.96 | 16.37 | 17.57 |
| Between 20 and 30 | 25.39 | 25.4 | 25.5 |
| Between 30 and 40 | 24.87 | 23.7 | 24.24 |
| Between 40 and 50 | 17.74 | 19.06 | 18.45 |
| More than 50 | 13.04 | 15.47 | 14.35 |
| Number of Children | 3.56 | 3.73 | 3.65 |
| | -2.93 | -3.56 | -3.29 |
| Total Spending | 1.73 | 1.44 | 1.57 |
| | -4.06 | -9.85 | -7.79 |
| Land Ownership | 75.54 | 99.52 | 88.68 |
| Risky Sex Index | | | |
| None or one partner | 76.45 | 90.91 | 84.4 |
| More than one partner with frequent condom use | 2.77 | 1.48 | 2.06 |
| More than one partner with no frequent condom use | 20.77 | 7.61 | 13.54 |
| Safe Sex | 79.23 | 92.39 | 86.46 |
| Multiple sexual partners | 23.55 | 9.09 | 15.6 |
| Number of partners in the last 12 months | | | |
| Zero or one Partner | 76.45 | 89.35 | 83.6 |
| Two partners | 18.58 | 8.26 | 12.86 |
| Three or more partners | 4.97 | 2.39 | 3.54 |
| Extra-Marital Relations | 25.47 | 13.39 | 18.85 |
| Observations (maximum) | 1725 | 2091 | 3816 |
| **Village characteristics** | | | |
| Stigma Index | 0.87 | -0.83 | -0.06 |
| | -1.4 | -0.64 | -1.35 |
| Proportion of people who would not allow a teacher with AIDS to teach | 0.23 | 0.07 | 0.15 |
| | -0.13 | -0.06 | -0.12 |
| Proportion of people who would not buy vegetables | | | |

Descriptive Statistics – Continued

| | | | |
|---|---|---|---|
| or fresh fruits if vendor has AIDS | 0.24 | 0.08 | 0.15 |
| | -0.15 | -0.08 | -0.14 |
| Proportion of people with radio | 74.96 | 74.45 | 74.68 |
| | -12.42 | -10.32 | -11.32 |
| Average age | 32.66 | 32.52 | 32.58 |
| | -3.63 | -3.68 | -3.66 |
| Proportion of women | 0. 54 | 0. 54 | 0.54 |
| | (0. 04) | (0. 04) | (0. 04) |
| Proportion of married respondents | 0. 80 | 0. 80 | 0. 80 |
| | (0. 07) | (0. 07) | (0. 07) |
| Proportion of separated respondents | 0. 05 | 0. 05 | 0. 05 |
| | (0. 03) | (0. 03) | (0. 03) |
| Proportion with primary school | 0. 64 | 0. 64 | 0. 64 |
| | (0. 13) | (0. 13) | (0. 13) |
| Proportion with secondary school or higher | 0. 14 | 0. 14 | 0. 14 |
| | (0. 14) | (0. 14) | (0. 14) |
| Average number of children | 3.59 | 3.57 | 3.58 |
| | -0.71 | -0.66 | -0.67 |
| Average total spending | 1.61 | 1.58 | 1.59 |
| | -1.16 | -1.15 | -1.15 |
| Proportion of respondents with land | 0. 66 | 0. 67 | 0.67 |
| | (0. 08) | -0.08 | -0.08 |
| Observations | 60 | 60 | 60 |

*Tab. 2.2:* Association between Proportion of Population with Radio and Social Stigma in 2004 and 2006 at the Village Level.

| | Stigma Index in 2004 | Stigma Index in 2006 |
|---|---|---|
| Prop. of People with Radio in Village | -0.009 | -0.021** |
| | (0.011) | (0.008) |
| **Marital Status (Prop. in Village)** | | |
| Married | -1.218 | 2.272* |
| | (1.573) | (1.232) |
| Separated | -2.805 | 0.634 |
| | (5.453) | (3.17) |
| Women | 1.432 | 3.511* |
| | (1.854) | (1.791) |
| Age | -0.042 | -0.027 |
| | (0.033) | (0.03) |
| **Education (Prop. in Village)** | | |
| Primary Schooling | -3.225*** | -1.664*** |
| | (1.037) | (0.44) |
| Secondary Schooling or Higher | -5.563*** | -2.054** |
| | (1.717) | (0.829) |
| North | -1.023*** | 0.238 |
| | (0.326) | (0.257) |
| South | -0.233 | 0.242 |
| | (0.46) | (0.234) |
| Number of Children | -0.152 | -0.104 |
| | (0.146) | (0.137) |
| Total Spending (in thousands | -0.186*** | 0.0334 |
| of *Kwachas* current prices) | (0.063) | (0.066) |
| Land Ownership | -2.082 | -1.55 |
| | (1.42) | (1.238) |
| Constant | 9.718*** | 0.742 |
| | (2.664) | (1.708) |
| Observations | 1717 | 2091 |

Robust Standard Error in Parentheses, Clustered at the Village Level
* significant at 10%; ** significant at 5%; *** significant at 1%.

Tab. 2.3: Relationship between Stigma and Risky Sexual Behavior: OLS Regression Results

| | # of Sex. Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Extra Mar. Relations |
|---|---|---|---|---|---|
| Stigma Index | 0.084** | 0.082** | -0.028 | 0.054** | 0.056*** |
| | (0.038) | (0.039) | (0.019) | (0.021) | (0.021) |
| **Vil. Char. in 2006** | | | | | |
| Age | 0.004 | 0.019** | -0.011** | 0.008 | 0.01 |
| | (0.007) | (0.01) | (0.005) | (0.005) | (0.007) |
| Women | 0.846* | 1.344*** | -0.694*** | 0.650** | 0.670** |
| | (0.464) | (0.489) | (0.232) | (0.275) | (0.319) |
| **Marital Status** | | | | | |
| Married | -0.676 | -0.397 | 0.23 | -0.167 | -0.750* |
| | (0.428) | (0.638) | (0.323) | (0.328) | (0.408) |
| Separated | -1.385 | -1.041 | 0.605 | -0.436 | -0.667 |
| | (1.076) | (0.962) | (0.452) | (0.545) | (0.617) |
| **Education** | | | | | |
| Primary Schooling | -0.49 | -0.451 | 0.179 | -0.272 | -0.418* |
| | (0.297) | (0.33) | (0.159) | (0.176) | (0.212) |
| Sec. Schooling | -0.907** | -0.475 | 0.159 | -0.316 | -0.448 |
| or Higher | (0.445) | (0.49) | (0.242) | (0.255) | (0.332) |
| **Other Controls** | | | | | |
| Total Spending | -0.011 | -0.009 | 0.003 | -0.006 | -0.004 |
| | (0.016) | (0.021) | (0.01) | (0.011) | (0.009) |
| Number of Children | -0.017 | -0.032 | 0.016 | -0.017 | -0.009 |
| | (0.033) | (0.04) | (0.021) | (0.021) | (0.036) |
| Land Ownership | -0.318 | -0.228 | 0.002 | -0.226 | -0.223 |
| | (0.32) | (0.51) | (0.251) | (0.265) | (0.296) |
| North | 0.019 | 0.019 | -0.039 | -0.02 | -0.052 |
| | (0.107) | (0.101) | (0.048) | (0.056) | (0.069) |
| South | -0.234** | -0.286** | 0.121* | -0.165** | -0.133* |
| | (0.109) | (0.124) | (0.062) | (0.064) | (0.07) |
| **Resp. Char.** | | | | | |
| Age | 0.001 | -0.001 | 0 | 0 | -0.002 |
| | (0.002) | (0.003) | (0.002) | (0.002) | (0.002) |
| Age Squared | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Married | 0.294*** | -0.126*** | 0.078*** | -0.049*** | |
| | (0.035) | (0.031) | (0.015) | (0.017) | |
| Women | -0.310*** | -0.395*** | 0.181*** | -0.214*** | -0.190*** |
| | (0.029) | (0.031) | (0.014) | (0.017) | (0.021) |
| **Education** | | | | | |
| Primary Schooling | 0.042 | 0.037 | -0.022 | 0.015 | 0.014 |
| | (0.03) | (0.031) | (0.016) | (0.016) | (0.017) |

Continued on Next Page...

Table 2.3 – Continued

| | # of Sex. Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Extra Mar. Relations |
|---|---|---|---|---|---|
| Sec. Schooling | 0.057 | 0.041 | -0.022 | 0.019 | 0.019 |
| or Higher | (0.038) | (0.048) | (0.024) | (0.025) | (0.034) |
| Number of Children | 0.010** | 0.020*** | -0.010*** | 0.011*** | 0.011*** |
| | (0.004) | (0.006) | (0.003) | (0.003) | (0.004) |
| Total Spending | 0 | 0.001 | 0 | 0 | 0 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Land Ownership | 0.001 | -0.066* | 0.039* | -0.027 | 0.056* |
| | (0.033) | (0.039) | (0.02) | (0.019) | (0.031) |
| Year 2006 | 1.01 | -0.143 | 0.291 | 0.148 | 0.58 |
| | (0.851) | (0.964) | (0.49) | (0.484) | (0.6) |
| Constant | 1.021*** | 1.594*** | 0.726*** | 0.320*** | 0.281*** |
| | (0.073) | (0.077) | (0.036) | (0.042) | (0.05) |
| Observations | 3467 | 3434 | 3434 | 3434 | 2966 |

[1]Village Fixed Effects Included. Regressions include indicator for missing education.
[2]Robust Standard Error in Parentheses, Clustered at the Village Level
[3]* significant at 10%; ** significant at 5%; *** significant at 1%

Tab. 2.4: Impact of Radio Ownership on Changes in Social Stigma: First-Stage Instrumental Variables Regression Results

| | Social Stigma |
|---|---|
| Proportion of Radio in Village in 2006 | -0.033** |
| | (0.013) |
| **Village Characteristics in 2006** | |
| Age | 0.005 |
| | (0.034) |
| Women | 2.297 |
| | (2.072) |
| **Marital Status** | |
| Married | 5.684*** |
| | (1.982) |
| Separated | 0.895 |
| | (4.286) |
| **Education** | |
| Primary Schooling | 2.154** |
| | (0.819) |
| Secondary Schooling or Higher | 5.544*** |
| | (1.363) |
| **Other Controls** | |
| Total Spending | 0.258** |
| | (0.101) |
| Number of Children | 0.0824 |
| | (0.174) |
| Land Ownership | -0.346 |
| | (1.741) |
| North | 0.987*** |
| | (0.341) |
| South | 0.530* |
| | (0.290) |
| **Respondent Characteristics** | |
| Age | 0.000 |
| | (0.001) |
| Age Squared | -0.000 |
| | (0.000) |
| Married | -0.019** |
| | (0.009) |
| Women | 0.011** |
| | (0.005) |
| **Education** | |
| Primary Schooling | 0.024** |
| | (0.011) |

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Table 2.4 – Continued

| | Social Stigma |
|---|---|
| Secondary Schooling or Higher | 0.010 |
| | (0.015) |
| Number of Children | -0.002 |
| | (0.002) |
| Total Spending | -0.000 |
| | (0.000) |
| Land Ownership | 0.018 |
| | (0.018) |
| Year 2006 | -8.760*** |
| | (2.275) |
| Constant | -0.492*** |
| | (0.128) |
| Observations | 3467 |
| **F-Test (Proportion of Radio in Village in 2006** | |
| F-Statistic | 7.86 |
| P-Value | 0.007 |

[1]Village Fixed Effects Included. Regressions include indicator for missing education.
[2]Robust Standard Error in Parentheses, Clustered at the Village Level
[3]* significant at 10%; ** significant at 5%; *** significant at 1%

Tab. 2.5: Relationship between Stigma and Risky Sexual Behavior: IV Regression Results

| | # of Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Ext. Mar. Relations |
|---|---|---|---|---|---|
| Stigma Index | 0.193* | 0.235* | -0.109 | 0.127* | 0.114 |
| | (0.099) | (0.136) | (0.068) | (0.069) | (0.070) |
| ***AR Weak Inst.Test*** | | | | | |
| *Test-Statistic* | *9.51* | *8.42* | *6.62* | *9.78* | *2.72* |
| *P-Value* | *0.002* | *0.004* | *0.010* | *0.002* | *0.100* |
| *95% CI* | *[0.07;0.58]* | *[0.06;0.77]* | *[-0.38;-0.02]* | *[0.04;0.40]* | *[-0.01;0.39]* |
| **Vil. Char in 2006** | | | | | |
| Age | 0.001 | 0.015 | -0.009* | 0.006 | 0.008 |
| | (0.008) | (0.011) | (0.005) | (0.006) | (0.007) |
| Women | 0.820 | 1.296** | -0.669** | 0.627* | 0.612 |
| | (0.537) | (0.619) | (0.300) | (0.333) | (0.386) |
| **Marital Status** | | | | | |
| Married | -1.095* | -0.977 | 0.537 | -0.441 | -0.950** |
| | (0.614) | (0.978) | (0.498) | (0.492) | (0.428) |
| Separated | -1.856* | -1.768 | 0.989 | -0.778 | -0.942 |
| | (1.063) | (1.306) | (0.681) | (0.654) | (0.663) |
| **Education** | | | | | |
| Primary Schooling | -0.685** | -0.734** | 0.329* | -0.405** | -0.530*** |
| | (0.286) | (0.363) | (0.182) | (0.186) | (0.185) |
| Sec. School. or Higher | -1.398** | -1.182 | 0.533 | -0.649* | -0.712* |
| | (0.561) | (0.771) | (0.389) | (0.388) | (0.370) |
| **Other Controls** | | | | | |
| Number of Children | -0.023 | -0.042 | 0.021 | -0.021 | -0.013 |
| | (0.040) | (0.054) | (0.028) | (0.026) | (0.038) |
| Total Spending | -0.029 | -0.036 | 0.017 | -0.019 | -0.015 |
| | (0.029) | (0.039) | (0.019) | (0.020) | (0.019) |
| Land Ownership | -0.275 | -0.145 | -0.042 | -0.187 | -0.199 |
| | (0.327) | (0.528) | (0.261) | (0.273) | (0.300) |

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Table 2.5 – Continued

| | # of Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Ext. Mar. Relations |
|---|---|---|---|---|---|
| North | -0.089 | -0.128 | 0.038 | -0.090 | -0.108 |
| | (0.137) | (0.144) | (0.074) | (0.073) | (0.093) |
| South | -0.292*** | -0.368*** | 0.165** | -0.203*** | -0.166** |
| | (0.107) | (0.130) | (0.066) | (0.066) | (0.065) |
| **Resp. Char** | | | | | |
| Age | 0.000 | -0.001 | 0.000 | -0.001 | -0.002 |
| | (0.002) | (0.003) | (0.002) | (0.002) | (0.002) |
| Age Squared | -0.000* | -0.000 | 0.000 | -0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Married | 0.298*** | -0.121*** | 0.075*** | -0.0463*** | |
| | (0.034) | (0.030) | (0.015) | (0.017) | |
| Women | -0.312*** | -0.397*** | 0.182*** | -0.215*** | -0.190*** |
| | (0.028) | (0.030) | (0.014) | (0.017) | (0.020) |
| **Education** | | | | | |
| Primary Schooling | 0.040 | 0.033 | -0.020 | 0.013 | 0.012 |
| | (0.030) | (0.031) | (0.016) | (0.016) | (0.017) |
| Sec. School. or Higher | 0.056 | 0.038 | -0.021 | 0.018 | 0.018 |
| | (0.037) | (0.048) | (0.023) | (0.025) | (0.033) |
| Number of Children | 0.010** | 0.021*** | -0.010*** | 0.011*** | 0.011*** |
| | (0.004) | (0.006) | (0.003) | (0.003) | (0.004) |
| Total Spending | 0.000 | 0.001 | -0.000 | 0.000 | 0.000 |
| | (0.001) | (0.001) | (0.000) | (0.001) | (0.001) |
| Land Ownership | -0.010 | -0.069* | 0.040* | -0.029 | 0.059* |
| | (0.033) | (0.040) | (0.021) | (0.020) | (0.030) |
| Land Ownership in 2006 | 0.278* | 0.040 | -0.018 | 0.022 | -0.070 |
| | (0.158) | (0.138) | (0.077) | (0.062) | (0.072) |
| Year 2006 | 1.687 | 1.134 | -0.387 | 0.747 | 1.159* |
| | (1.112) | (1.366) | (0.699) | (0.682) | (0.690) |

Continued on Next Page...

Table 2.5 – Continued

| | # of Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Ext. Mar. Relations |
|---|---|---|---|---|---|
| Observations | 3467 | 3434 | 3434 | 3434 | 2966 |
| **F-Test (Prop of Radio Vil. in 2006)** | | | | | |
| F-Statistic | 7.87 | 7.83 | 7.83 | 7.83 | 6.51 |
| P-Value | 0.007 | 0.007 | 0.007 | 0.007 | 0.01 |

[1]Village Fixed Effects Included. Robust Standard Error in Parentheses, Clustered at the Village Level.
[2]Regressions include indicator for missing education.
[3] * significant at 10%; ** significant at 5%; *** significant at 1%

## 2.A Appendix

Tab. 2.6: Impact of Social Stigma on Sexual Behavior
Instrumental Variable Specifications for Men

| | # of Sex. Part. Last 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Extra Mar. Relations |
|---|---|---|---|---|---|
| Stigma Index | 0.373** | 0.421* | -0.188 | 0.233* | 0.166 |
| | (0.167) | (0.246) | (0.126) | (0.123) | (0.134) |
| ***AR Weak Inst Test*** | | | | | |
| *Test-Statistic* | *14.88* | *5.92* | *4.11* | *7.73* | *2.22* |
| *P-Value* | *0.000* | *0.015* | *0.043* | *0.005* | *0.136* |
| *95% CI* | *[0.18;1.03]* | *[0.08;1.39]* | *[-0.68;0.14]* | *[0.06; 0.72]* | *[0.04;0.69]* |
| Observations | 1640 | 1610 | 1610 | 1610 | 1271 |
| F-Test (Proportion of Radio in Village in 2006) | | | | | |
| **F-Statistic** | 7.44 | 7.44 | 7.44 | 7.44 | 5.78 |
| **P-Value** | 0.008 | 0.008 | 0.008 | 0.008 | 0.019 |

[1]Regressions include the same controls as in Table 6 (other coefficients not shown)
[2]Robust Standard Error in Parentheses, Clustered at the Village Level
[3]* significant at 10%; ** significant at 5%; *** significant at 1%

Tab. 2.7: Impact of Social Stigma on Sexual Behavior
Instrumental Variable Specifications for Women

| | # of Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Ext. Mar. Relations |
|---|---|---|---|---|---|
| Stigma Index | 0.010 | 0.031 | -0.024 | 0.007 | 0.062 |
| | (0.087) | (0.104) | (0.051) | (0.054) | (0.072) |
| ***AR Weak Inst. Test*** | | | | | |
| *Test-Statistic* | *0.01* | *2.27* | *1.74* | *2.78* | *0.05* |
| *P-Value* | *0.936* | *0.132* | *0.187* | *0.10* | *0.82* |
| *95% CI* | *[-0.22;0.13]* | *[-0.01;0.21]* | *[-0.10;0,01]* | *[-0.00; 0.11]* | *[-0.16;0.16]* |
| Observations | 1827 | 1824 | 1824 | 1824 | 1695 |

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Table 2.7 – Continued

| | # of Part. 12 months | Risky Sex Index | Safe Sex | Multiple Partners | Ext.- Mar. Relations |
|---|---|---|---|---|---|
| F-Test (Proportion of Radio in Village in 2006) | | | | | |
| **F-Statistic** | 7.79 | 7.79 | 7.79 | 7.79 | 6.79 |
| **P-Value** | 0.007 | 0.007 | 0.007 | 0.007 | 0.012 |

[1]Regressions include the same controls as in Table 6 (other coefficients not shown)
[2]Robust Standard Error in Parentheses, Clustered at the Village Level
[3]* significant at 10%; ** significant at 5%; *** significant at 1%

# 3. CHILDHOOD OBESITY DILEMMA: PARENTS' LACK OF KNOWLEDGE OR LACK OF POWER

## *3.1 Introduction*

Obesity has become a major concern in public health policy, and is responsible not only for the rise of chronic diseases but also for a drop in labor productivity, representing a cost rising to as much as 10 percent of national GDP in the US (Sassi (2010)). Recent estimates show that over 10 percent of the world's school-aged children are obese, imposing an enormous pressure on the sustainability of national health systems, as these youth have a 50 percent chance of becoming obese adults. This situation is also present in Portugal, where one of the few studies reports estimates suggesting that 29.4 and 33.4 percent of 7-9 year old boys and girls, respectively, are overweight or obese (Padez *et al.* (2004)). These figures underscore the need to understand the determinants and causes of childhood obesity in order to design adequate policies to reverse this dramatic trend. Improvements in technology, increased income, decreases in food prices, maternal employment, and lack of parents' perception of the problem have all been pointed to as potential causes for the increasing child obesity. While there is an extensive US-based literature (Anderson *et al.* (2003), Bethell *et al.* (2010), Cawley (2010), Lobstein *et al.* (2004), among others), little is known about the importance of these determinants in Portugal.

Several studies have focused on the important role of parents in preventing and fighting childhood obesity, either by orienting or imposing nutritional habits or promoting physical exercise. (See, for example, Golan (2006) and Lindsay *et al.* (2006)). In addition, some have argued that parents, especially those of overweight children, have a

misconception about the true nutritional status of their son or daughter and it might influence the way they behave (Evans and He (2007), Intagliata *et al.* (2008)).

Despite the alleged importance of parents role, due to lack of data, no study has focused on the subjective probability that parents assign to childhood obesity according to the mix of energy intake and expenditure. The importance of expectations on decisions-making have long been addressed in theoretical frameworks as in Philipson and Posner (1993) and Fisher and Fisher (1992). These theoretical studies were often non translated into empirical studies due to the lack of correct expectation measurements. In this context, a first strand of literature focused on developing measures to elicit probabilistic expectations, i.e., *expectations that are measured on a well-defined numerical scale, that are comparable across domains, and that can be interpreted as probabilities*, and show whether people provided coherent answers both in developed (Manski (2004)) and developing (Delavande and Kohler (2009)) countries. The general findings is that individuals are able and willing to provide meaningful answers in probabilistic formal.

A more recent strand of literature uses those expectations to better understand behavior in setting such as fertility (Delavande (2008)), schooling (Dominitz and Manski (1996)), or social security benefits (Delavande and Rohwedder (2011)): the decision-maker relies on her subjective expectations about the result of her actions, when deciding what contraception method to use, how many years of schooling to enrol in which fraction of wealth to invest in stock. It is likely that in the childhood obesity context the same reasoning applies, i.e., when parents choose the type of food and drinks they provide their child with and the physical exercise in which they enrol their son or daughter, they are taking into account their *subjective* belief about the impact of such decisions. More specifically, they will behave according to what they expect to be the likelihood of their child becoming overweight, conditional on their choices. As Delavande (2008) stated, observed choices may be consistent with different combinations of expectations and preferences. In this childhood obesity context a parent could let the child consume a very high level of sugar-added beverages when believing that the quantity does not influence

the likelihood of obesity or because the child has the main control over the consumption decisions within the household, even if the parent believes such consumption to boost the obesity probability.

To overcome this identification problem, and investigate the link between parents perceptions about how their decisions affect the likelihood of their child becoming overweight and the subsequent decisions, we designed and conducted a survey in seven private primary schools in Portugal, collecting data from both the parent and the child nutritional health habits. Using the collected data we (i) analyze the correlation between food intake and exercise with the propensity of childhood obesity, (ii) describe parents' subjective expectations about the conditional probability of their child becoming obese, (iii) describe the decision power distribution regarding consumption decisions within the household and (iv) investigate how the two prior-elicited measures explain parent's decision-making.

We find that the child's Body Mass Index (BMI) is positively correlated with the consumption of soft drinks, sweets, and high-fat snacks and negatively with physical exercise practice, which is consistent with the prevailing literature (although not all associations are statistically significant in our sample). According to our econometric specification evidence shows that the greater the parents' decision power, the fewer soft drinks they will their child consume on a weekly basis, especially if they perceive their son or daughter to be overweight. Using the change in the perceived probability of obesity to measure the perceived importance of soft drink consumption in the likelihood of child obesity, we conclude that the greater the perceived increase in the probability of childhood obesity by increasing soft drink consumption, the fewer such beverages their children will consume. This suggests that providing parents with the right knowledge about the consequences of drinking sweetened-beverages may be a primary vehicle in fighting childhood obesity.

The remainder of the paper is organized as follows. Section 3.2 describes both the trends and determinants of the childhood obesity epidemic. Section 3.3 describes the questionnaire, while Section 3.4 presents the descriptive statistics of the sample. Section 3.5 works on the elicited subjective expectations of parents and evaluates whether parents have accurate expectations. Finally, Section 3.6 presents the empirical approach and the

results, and Section 3.7 concludes.

## 3.2 The Childhood Obesity Epidemic

### 3.2.1 Childhood Obesity Trends

The rise of obesity has placed the disease in a central position in the public health policy. The change in nutrition habits, with the drastic reduction of food prices and the sharp decrease in physical activity have raised this health condition to a status of epidemic, both in developed and developing countries. While industrialization and prosperity have enabled an unprecedented improvement in populations' health, where the increase in height and weight was, at first, beneficial to our ancestors, it has been accompanied by the rise of chronic diseases for which obesity is a risk factor (Sassi (2010)). In the last 30 years the BMI has increased sharply, boosting the obesity rate. The World Health Organization (WHO) reports that obesity has reached an epidemic proportion, with more than 1 billion overweight adults, of which 300 million are obese.

In parallel with adult obesity, childhood and adolescent obesity has also increased drastically in recent decades. In the US, childhood obesity increased from 6.5 percent in 1980 to 19.6 in 2008, while prevalence among adolescents increased from 5 to 18.1 percent (Ogden *et al.* (2010)). Lobstein *et al.* (2004) show that 10 percent of the world's school-aged children are overweight, of which a quarter are obese.

This epidemic has both short and long-term effects. On the one hand, the odds are 1.32 times greater for an overweight child to repeat a grade and 1.59 to miss more than two weeks of school during the school year (Bethell *et al.* (2010)). In a long-run perspective, approximately 70 percent of obese youth have at least one additional risk factor for developing a cardiovascular disease, and children who are obese after age 6 have greater than a 50 percent chance of becoming obese adults (Frieden *et al.* (2010)). The associated overall costs have placed childhood obesity into a central position of health policy,

making it extremely important to understand the causes and consequences, so that the adequate policies can be designed and implemented.

Similarly to the rest of the world, Portugal has also experienced an increase in the proportion of overweight and obese children. One of the few existing national studies compared the first national survey with a recent dataset, covering 4,511 Portuguese children aged 7-9 years old, to document the trends of BMI from 1970-2002. (Padez *et al.* (2004)). These authors stress the differences between 1970-1992 and 1992-2002 trends, where the velocity of the increase of BMI is higher in the latter period, due to higher growth rate of weight *vis-à-vis* the height growth rate.

Most studies about childhood obesity in Portugal are regional-level based and show some variations in the prevalence of overweight and obesity across regions. While in the autonomous region of Madeira, Sousa *et al.* (2006) report that 17.3% and 14.4% of boys and girls are obese, respectively, in Amarante the same rates do not exceed 6% for either gender (Maia and Sousa (2005)). Similar studies found an obesity rate of 13.2% for boys and 12.6% for girls in Gaia (Mota *et al.* (2006)), whereas the analogous rates in Coimbra were 6.5% and 6.9% (Rito (2006)). Despite the regional variation, the overall picture is alarming, and efforts must be made to correctly identify its causes.

### *3.2.2 Determinants of childhood obesity*

As the childhood obesity epidemic has risen much effort has been devoted to understand its determinants. At a basic level obesity is a result of an imbalance between the caloric intake and the amount of energy spent. What is left to explain is the cause of the change in the nutrition equilibrium.

Several studies, e.g. Janssen *et al.* (2005), have studied the relationship between dietary intake and propensity to obesity and found no solid association. However, the authors show that in countries where physical activity is lower and television viewing is higher, the proportion of overweight and obese children is higher. In exploring the changes in food consumption and energy expenditure behaviors many explanations have been advanced.

The decline of the real price of fast food (a McDonald's quarter-pounder with cheese fell 5.44%) and the increase of 17% on the price of fruits and vegetables between 1997 and 2003 have been pointed to as one of the explanations of increasingly high-sugar and high-fat dietary behavior in the US (Raschad and Christian (2009) and Powell (2009)). Regarding incomes' impact on obesity, the views are contradictory. On the one hand, some argue that an increase in income would allow people to make healthier choices, decreasing the likelihood of obesity (Philipson (2001)). On the other hand, the increase in income could boost weight gain, by allowing people to consume more calories and have more sedentary habits (Schmeiser (2009) and Cawley *et al.* (2010)).

Other than the direct food habits of population and income, other explanations have been advanced to explain childhood obesity. The increase in maternal employment has been associated with a higher likelihood of the child being obese. More specifically, research has shown that the number of hours worked per week is a determinant of the propensity to be obese (Anderson *et al.* (2003) and Scholder (2008)), in which these results are driven by the lower socio-economic groups. Further research has investigated the mechanisms that drive this correlation. Fertig *et al.* (2009) found that maternal employment is negatively related to children's BMI through the average number of meals consumed, through reading, talking, and listening to music, and through the increased amount of time spent in school or child care. Similarly, children with working mothers watch more TV, which is positively associated with obesity.

Besides parents' time allocation, their perception about their son or daughter's nutritional status plays a role. Several studies have shown that parents routinely underestimate the nutritional status of their children, especially those of overweight children (Evans and He (2007); Wald *et al.* (2007); De La O A *et al.* (2009); Intagliata *et al.* (2008)). Eckstein *et al.* (2006) developed a visual scale on which parents could identify the figure that most resembles their child(ren). In an application to Portugal, Gomes *et al.* (2010) found that 87 percent of overweight or obese children's parents identified them as having a weight at most the average of the age-appropriate weight.

We contribute to this literature by introducing two new explanations for the parents' decisions about household food consumption and energy expenditure: their subjective expectations of childhood obesity conditional on calorie intake and energy expenditure and how the child influence power in consumption decisions can impact parents' behaviors. To our knowledge no other study has introduced these two explanations into the problem and few have modeled a general framework of time and resource allocation in this context (You and Davis (2007)).

## *3.3 Data Collection*

One of the main innovation of this project is the collection of a new dataset in primary schools.

### *3.3.1 Sample*

The data were obtained through a take-home self-administered questionnaire for the parents, covering seven private primary schools in Portugal between April and June, 2011: four in the district of Lisbon, two in the district of Setúbal and one in the district of Porto.[1] As shown in Table 3.1, the data comprise 220 parents, with 83.64% women. The average age is 40 years, 73.52% have an university degree, and the majority are married (84.86%). Families (either two or single parent) have, on average, 2.1 children. Children in the sample are aged 7 to 9 years old, with an average age of 7.81.

Since our sample comprises seven private schools the income distribution is upward biased when compared to the national reported, with 74% of families reporting an average monthly income of more than 2,500 Euro. The average response rate across the primary schools in the sample is 27%.

[1] In order to overcome the possible bias on results due to the focus on private schools, several attempts were made to obtain the approval of *Ministério da Educação* to cover primary public schools, but no reply was ever received. Nonetheless, two of the Lisbon schools are *Instituições Privadas de Solidariedade Social (IPSS)* where parents pay according to their income tax declaration, so this sub-sample might mitigate the possible bias.

### *3.3.2 Questionnaire Design*

The questionnaire that was delivered to the parents has nine sections: socio-demographic information of the parent, health and nutrition of the parent, health and nutrition of the child, perceptions, hypothetical situations, time allocation distribution, income allocation distribution, family nutrition habits, and consumption decisions. The questionnaire is presented in the Appendix, in its original version (Portuguese) and in English. The remainder of this section describes in more detail the most important sections, especially the ones that lead to the elicitation of the subjective beliefs and the household decision-making power distribution.

#### *Socio demographic and health related questions*

Regarding the socio-demographic section about the parent, the questionnaire asked: age, gender, education, marital status, household income and number of children. The health and nutrition of the parent section included questions on the self-assessed weight, height, and physical exercise habits of the parent. Similarly, the analogous questions related to children asked about weight and height reported by the parents, existence of chronic diseases, and physical activity habits.

#### *Time and Income Allocation*

Direct questions addressed the daily average number of minutes working, spent with children, cooking or preparing meals, and in leisure activities on a typical workday and a typical weekend day, from both the respondent and the spouse. For the income allocation, we included questions on the monthly spending decisions: amount spent on groceries (splitting between vegetables/fruits and high-sugar and high-fat food like sodas, sweets, high-fat snacks), household expenses and education expenses.

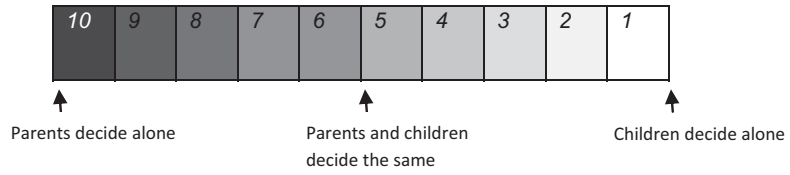
#### *Child Influence power*

To assess the child influence power parents were explicitly asked if their children expressed their wishes about the goods to purchase and the frequency that parents attended to their

child's wishes. Moreover, with a visual scale ranging from 1 to 10 (presented in Figure 3.3.2) parents were asked the following:

*Imagine the consumption decisions, about a list of different products, on a typical trip to the supermarket. In a scale from 1 to 10 indicate who participates in the choice of the products: sweets / soft drinks / vegetables and fruit*

*Fig. 3.1:* Scale of the distribution of parent-child decision power




*Perceptions and Subjective Expectations*

Several studies have shown that parents routinely underestimate the nutritional status of their children, especially parents of those children who are overweight (Evans and He (2007), Wald *et al.* (2007), De La O A *et al.* (2009), Intagliata *et al.* (2008)). Eckstein *et al.* (2006) has developed a visual scale where parents can identify the figure that most resembles their children. In an application to Portugal, Gomes *et al.* (2010) found that 87% of overweight or obese children's parents identified them has having a weight that was at most the average of the age-appropriate weight. In our setting we wished to investigate two aspects of parents' perceptions: not only how they currently identified their children's nutritional status, but also to measure parents' perceptions about how some inputs (allowing them to drink more soft drinks or increasing their physical exercise activity) will impact their health. We asked two types of questions:

1. To measure the perception that parents have of the current nutritional status of the children, we asked directly if parents believe their children to be underweight, of the appropriate weight or overweight. Also, to have a comparison with the literature, we asked parents to identify on Eckstein *et al.* (2006)'s visual scale (See Figures 3.9 and 3.19 in the Appendix), the figure that most resembles their children.

2. To elicit the subjective beliefs, we relied on a set of hypothetical scenarios. The questionnaire posed probabilistic expectation questions that measure how parents revise their expectations regarding the children's nutritional status when engaging in different behaviors. More specifically, parents were asked what they believed to be the percent chance that their child would become obese in the next 12 months, conditional on parents' behaviors. To measure this perception, a set of hypothetical situations were included in the questionnaire:

   *In the next questions we will ask you to imagine different scenarios regarding your child's beverage consumption and the way he/she occupies his/her extra-curricular time. Namely, across scenarios we will change:*

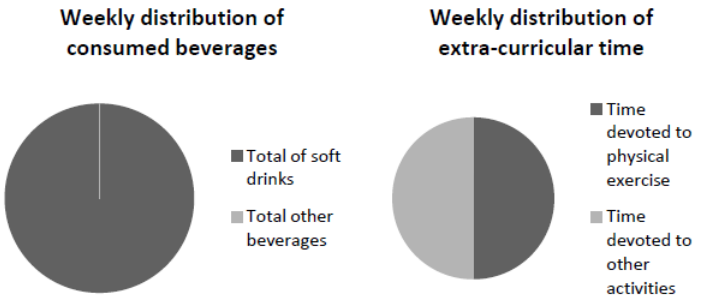
   - *the proportion of soft drinks (Coke, Iced-Tea, Sprite) consumed by your son/ daughter on a weekly basis, in relation to the total amount of consumed beverages (including water, milk, natural juices, etc.)*
   - *the proportion of time devoted to physical exercise of your son/daughter in extra-curricular activities, on a weekly basis, in relation to all other non-school activities (watching TV, video games, etc.)*

   Then, according to each pair of distributions each parent was asked: *Considering the combined effect of the amount of soft drinks and time devoted to physical activity what is the probability that your son/daughter becomes obese in the next 12 months?* We presented nine different scenarios in which we made all possible combinations, varying the amount of soft drinks from none, half of total beverage consumption, and total and the amount of physical exercise from none, half, and total.

To help parents visualize the change across scenarios we included two pie charts in which one represented the total amount of soft drinks in relation to the total amount of consumed beverages, and the other the total amount of extra-curricular time devoted to physical activity in relation to the total amount of off-school time. To illustrate the meaning of the pie charts, parents were presented with the following example:

*If your son / daughter drinks only soft drinks and devotes half of the extra-curricular time to physical activity, the distributions of consumed beverages and extra-curricular time would be, respectively, given by:*

*Fig. 3.2:* Distribution of total beverages and of extra-curricular time




## *3.4 Descriptive Statistics*

### *3.4.1 Nutritional Status of the Parent*

We relied on their self-assessed height and weight and computed their BMI[2]. After computing the BMI we classified parents' nutritional status according to the World Health Organization cut-off, where a BMI under 18.5 means underweight, between 18.5 and 24.9 reveals a normal weight, between 24.9 and 29.9 overweight, and above 30 stands for

[2] The standard formula to compute the BMI using the metric system is $BMI = \frac{weightinkilograms}{heightinmeters^2}$

obesity. In our sample we have a smaller proportion of the population being overweight or obese. While national data from 2003-2006 (WHO) reported 39% of overweight and 14% of obese people, in our sample the proportions are of 23.64% and 2.73%, respectively.

To check how parents evaluate their own nutritional status we asked if they perceive themselves as being Underweight / With the adequate weight / Overweight or Obese. Results are present in the top of Table 3.3. Also, we compared their real nutritional status, assessed through their BMI, with their perception of their appearance. Data show that parents are realistic concerning their own weight: 76.92% of overweight adults believe themselves to be slightly overweight and 66.66% of obese adults report being slightly or highly overweight (in equal shares)[3].

### *3.4.2 Perceived Nutritional Status of the Child*

The nutritional status of the child was also obtained after computing the BMI, based on parents self-report. Given the rapid growth of young people, the classification by nutritional-status is not obtained solely according to this index. After BMI is calculated for children and teens, the BMI number is plotted on the BMI-for-age growth charts (for either girls or boys) to obtain a percentile ranking. The percentile indicates the relative position of the child's BMI number among children of the same sex and age. Classification is as follows: underweight (percentile lower than 5%), healthy weight (percentile between 5% and 85%) overweight (percentile between 85% and 95%), and obese (percentile over 95%)[4]. Table 3.2 reports the same pattern in the distribution as of the overall national scenario with 10.92% of overweight and 4.60% of obese. Breaking down by gender, 13.54% of girls are overweight (7.69% boys) and 4.17% of girls are obese (5.13% for boys).

An important analysis is how parents see their child's nutritional status, i.e., their

[3] not shown, available upon request

[4] See the Center for Disease Control and Prevention (CDC) for a detailed explanation of how the nutritional status of children is computed.

perception of their child's "size". Using a scale that ranges from 1 "Very Underweight" to 5 "Very Overweight", 62.56% of parents report their children to have the adequate size, with only 8.68% thinking to have slightly overweight children. Splitting the analysis by the real nutritional status , parents usually believe their children to be thinner than they are: 28.03% of parents of children with adequate weight believe them to be slightly underweight, 68.42% of parents of overweight children say they have the adequate size and 25% of parents of obese children think they have the normal weight (50% believe they are slightly overweight).

As an alternative measure we made use of the Eckstein *et al.* (2006) visual scale. The scale is split by gender and age categories and each has seven figures of a boy/girl where the central one represents the median of the respective gender/age category. In our sample only 15.09% of the parents believe their children to be in the median of the distribution while 82.08% report them as being below this threshold. There is a strong correlation between the perception of the nutritional status of the child (elicited by the categorical question) and the one obtained using the visual scale (the correlation coefficient is 0.66 and significant at a 1% level of significance). Moreover, we have that all parents that perceive their child to be underweight identify them as being below the median, and 22% of those who report that their child is overweight, visually recognize them as being above the median weight.

### *3.4.3 Time and Income Allocation*

As said above, time and income allocation from the parents have consistently been pointed out has a main determinant of the propensity that the child becomes obese. In our analytical sample 90.28% of the respondents are employed and spend on average 8.15 hours per weekday working. The remaining time is spent doing housework (73.52 minutes), cooking (51.49 minutes), with their children (2 hours and 45 minutes) and in leisure activities (54 minutes). Parents spend, on average, 113.68 Euro per month on vegetables, 31.82 on high sugar products (chocolate, sweets, popcorn, ice cream, sugar-added cereals,

etc-) and 13.48 on high-fat grocery products. The bulk of the family expenses are due to household bills (such as electricity and gas) that are on average 282.88, and 922.18 on education. A simple correlation analysis of the time and income allocation variables with child's weight status shows that our data are consistent with the literature. Child's nutritional status (defined as a categorical variable, ranging from 1 to 4, where 1 stands for "Underweight" and 4 "Obesity") is positively correlated (0.063) with the amount parents spend on sugar-added products and negatively correlated with the amount that parents spend on vegetables, and time parents spend preparing meals and cooking (-0.1638 and -0.056, respectively). [5]

### *3.4.4 Health Habits*

In order to understand the health-related habits of the household members, the questionnaire included questions on the physical exercise and frequency of consumption of certain products. 51% of parents practice exercise regularly with an average of 2.4 times per week. As for the children, 98.18% do physical exercise, which is likely to include the mandatory physical education in school. However, an average of 2.89 times per week (higher than the two times per week mandatory in primary schooling) suggests that parents also enrol children in physical activity extra-curricular activities.

One family behavior that has been pointed to as an influence on the likelihood that a child is obese is the frequency that the household members eat together. In our sample, 86.3% of the families dine together more than 5 times per week, where 74.4% reported dining together everyday. Parents were also asked the frequency with which their children ate or drank a list of products. 72.77% of parents report that their children eat more than eight pieces of fruit per week and 67.45% state that they eat more than eight portions of vegetables weekly. In what concerns unhealthy nutritional habits: 83.03% drink at most three soft drinks per week, 65.90% eat a maximum of three sweets per week and the majority (55.91%) do not consume any high-fat snacks. Performing the same correlation

[5] Only the coefficient correlation between the nutritional status and the amount parents spend on vegetables is significant at a 10% level of significance.

analysis as above we have that the child's nutritional status is positively correlated with the consumption of sodas, sweets, and high-fat snacks (the correlation coefficients are 0.04, 0.04, and 0.31, respectively), and negatively with physical exercise (-0.08), which again is consistent with what is expected. Although the sign of the correlation is as expected, it is non-significant.

### *3.4.5 Child Decision Power*

The survey covered some questions to assess the distribution in the decision-making power between parents and children related to consumption decisions. In this set of questions parents were asked to imagine a typical shopping day and were asked how frequently their children expressed their consumption wishes and how often the parents attended to such wishes. Finally, they were asked how frequently children went shopping with their parents. Data presented in Table 3.7, show that most children (43.06%) express their wishes frequently and parents (65.89%) seldom attend to their wishes. Also, parents were queried on how much they and their children contributed to the decision about what and how many sweets, sodas, vegetables and fruits were purchased. As explained above, this was done using the help of the visual scale in Figure 3.1 that ranged from 1 (children decides alone) to 10 (parents decide alone). Results in Table 3.7 show that parents report an average of 9 points, which is close to the maximum of 10, where parents decide by themselves. This high score is likely to be over-reported if we take into account that 17.29% of parents admit they attend to their children's consumption wishes frequently.

### *3.4.6 Subjective Expectations*

#### *Unconditional Subjective Probability of Obesity*

Our questionnaire asked parents what the probability is that their child will become obese in the next 12 months. On average, parents report a 10.72% chance of this event happening. The Kernel density estimate of the unconditional probability of the child becoming obese in the next 12 months is presented in Figure 3.3. Although this subjective probability increases with the child's nutritional status (ranked from underweight to

obese), i.e., the unconditional distribution function becomes heavier in the right-tail, if we restrict the sample to those who are overweight, parents with currently obese children report, on average, only a 39.57% of chance of obesity in the next year.

*Conditional Subjective Probability of Obesity*

One of the main goals of our research is to assess the level of information that parents have, i.e., to evaluate how parents believe their choices affect their son's or daughter's nutritional status. Table 3.8 shows the average joint probabilities for the nine different scenarios used to elicit such beliefs. We see that, on average, when keeping exercise constant, a higher consumption of soft drinks is associated with a greater probability of future obesity. Likewise, keeping the consumption of sodas constant, a higher level of physical exercise is associated with a lower likelihood of the child becoming obese in the future.

According to parents' subjective expectations, the number of soft drinks is more of a determinant in the probability of obesity than the amount of exercise a child does. This conclusion can be reached if we look at the change in the average probability of obesity across scenarios: starting from the worst possible case (where a child drinks only soft drinks and does not devote any extra-curricular time to exercise), the average probability of becoming obese in the next 12 months is 64.35%. If, suddenly, the child cuts consumption the soft drinks in half, this probability drops by 33.4% to 42.71%, whereas if we were to keep the beverage habits constant and the child started devoting half of his/her spare time to physical activity, the change would be only 26.17%.

Figure 3.4 plots the quantiles of the probabilities of child obesity in the nine different scenarios we have presented parents with. In the first row soda consumption is set to the maximum, in the middle row we have half of soda consumption relative to all other beverages, and in the final row there is no soda consumption. Similarly, in the first column there is no physical activity from the child, in the middle column children spend half of their free time in physical exercise activities, and in the final devote all spare time

to such activities. This means that the upper left case is the worst in terms of child nutrition, where there is total consumption of soft drinks and no physical activity and the lower right case is the one that should lead to the lowest probability of obesity. This picture clearly shows the revision of subjective expectations from the parents, with the lowering of the probability of future obesity whenever there is a reduction in soft drink consumption or increase in time devoted to physical exercise. This means that, fixing the exercise level, the higher the difference between the probability of obesity in the high soda scenario and the one in the low soda scenario, the more people are changing their expectations. To understand the change of expectations we computed the change rate in the probability of obesity as follows. For the change in the probability due to a variation in the consumption level of soft drinks from the maximum value to the minimum, for each level of exercise, we have:

$$\triangle Prob(Y_i = 1|S_i, \overline{E}) = \frac{Prob(Y_i = 1|S_i = H, \overline{E}) - Prob(Y_i = 1|S_i = L, \overline{E})}{Prob(Y_i = 1|S_i = L, \overline{E})}$$

where $Y_i$ is a binary variable that is 1 when the child is obese, $S_i$ is the consumption of soft drinks which can be high ($H$), medium ($M$), or low ($L$), and $E$ is the exercise level which also can be high ($H$), medium ($M$), or low ($L$).

The analogous variation rate due to a change in the time allocated to physical exercise from the maximum value to the minimum, for each level of soft drink consumption, is given by:

$$\triangle Prob(Y_i = 1|\overline{S_i}, E) = \frac{(Y_i = 1|\overline{S_i}, E = H) - Prob(Y_i = 1|\overline{S_i}, E = L)}{Prob(Y_i = 1|\overline{S_i}, E = L)}.$$

The histogram of the distribution of each probability change rate, in the six possible scenarios, is presented in Figure 3.8. The evolution of the first row shows that when soft drink consumption drops from high to low there is a right-hand shift in the distribution. This means that, as the level of soft drink consumption decreases, the probability that the child becomes obese becomes more sensitive to changes in the exercise level, i.e., the

change in the probability is greater when we shift from high exercise to low exercise, if there is a low level of soft drink consumption. In opposition, the change in the subjective probability of obesity is lower when we reduce the level of exercise. As we can see in the lower set of histograms in Figure 3.8, as the exercise level goes from high to low there is a left-shift of the histogram. This means that parents adapt less their expectations in response to changes in the soft drink consumption when there is a low level of exercise. These variations should have an impact on parents' household decisions concerning the amount of soft drinks they allow their children to have and the physical exercise activities they enrol their children in. We would expect that the higher the variability, the greater the change in parent's behavior.

The evidence shown in this section suggests that there is much heterogeneity in the subjective expectations of future childhood obesity when varying the hypothetical scenarios. It is interesting to exploit more what is driving this variation, namely to understand how is it dependent of the gender of both parent and child, age of the child and nutritional status of the parent. Figure 3.5 shows the quantiles of conditional subjective probabilities, splitting by gender of the parent. The picture suggest, that overall, fathers tend to assign a higher probability to future childhood obesity. Although the difference in the average probabilistic expectation can rise up to 10% (when the exercise level is low and soft drink consumption is high), the average mean difference is non-significant. Despite not being shown, results are very similar across child gender, with the only significant difference in the average expected probability happening when there is a medium level of soft drink consumption and a high level of exercise. Figure 3.6 shows the same evolution in quantiles, splitting the sample by the child's age. Simple observation of the distribution quantiles show that parents usually assign a higher probability of obesity for older child. Nevertheless, only in the hypothetical scenarios with low exercise and high soft drink consumption, there is a significant difference between the average perceived probability of future obesity, across the different age groups.[6] Moreover, the revision of expectations is different depending on the child's age. For example, while the change in

[6] Results were obtained through the mean-comparison test, using one-way ANOVA.

the probability of obesity when we vary soft drink consumption from low to high, keeping exercise at the maximum level, is 12% if the child in 7 years old, it rises to 18% if the child is 9. This might reflect that parents believe that the weight of their children is more susceptible to changes by adapting behavior, the older the child is. Finally, the analysis by the nutritional status of the parent is sketched in Figure 3.7. A simple observation of the densities suggest that, while underweight parents systematically perceive a higher probability of obesity, especially if soft drink consumption is high, those who are obese tend to assign the lowest probability. This can reflect a selection problem: parents that are underweight are so, because they have nutritional habits inducing such weight. This could mean that, as they perceive a higher impact of soft drinks, they rationalize their consumption and control their BMI. Although the average probability of childhood obesity changes when soft drink consumption is high, the way they revise their expectations is unchanged.

## *3.5 Do parents have accurate expectations?*

Findings in the last section suggest that the change in parents' expectations is greater when varying the amount of soda consumed, keeping exercise constant, than when exercise is altered. The average change is 2% when the exercise level is decreased from high to low, keeping consumption of soft drinks high, and 5% for the same change with low soft drink consumption. This tells us that parents feel that exercise is less useful in preventing obesity if their child consumes a high level of soda. Similarly, parents believe that reducing sodas is more effective when the level of exercise is high than when it is low.

Although parents adapt their expectations in the same way, either by decreasing exercise or increasing soft drink consumption, the average change is much higher in the latter case. While the maximum change in the perceived probability of childhood obesity is 5% when we vary the exercise level, it rises to 11% when we change soda consumption from low to high, keeping exercise at a high level. This suggests that parents believe nutrition restrictions to be more successful than exercise promotion in preventing childhood obesity.

One of our purposes is to evaluate whether parents have the right perceptions concerning the real effect of soft drink consumption and physical exercise on the probability of childhood obesity. To investigate the accuracy of their expectations we rely on clinical and medical data intended to determine the existence and strength of such effects.

Although the evidence is inconclusive the, larger studies have substantiated the idea that sweetened beverage intake is related to being overweight among children. A large, representative study based on the National Health and Nutrition Examination Surveys by Troiano *et al.* (2000) measured height and weight directly and found a positive association between energy intake arising from soda consumption and being overweight. Furthermore, the Growing Up Today Study, a large-scale study with 16,679 children, (Berkey *et al.* (2004)), found that girls who drank more sugar-added beverages were heavier (BMI rose 0.06 points per serving). James (2005) also came to the conclusion that children who consume more soft drinks have a higher caloric intake and consequently are more likely to become overweight. In particular, an extra-daily soda increases the odds-ratio of becoming obese 1.6 times. In the Bogalusa Heart Study, Nicklas *et al.* (2003) found that consumption of sweetend beverages was significantly associated with being overweight (odds-ratio is 1.33) after adjustment for energy, age, study year, ethnicity, gender and gender interacted with ethnicity. In opposition, in a smaller-scale study, also US-based, that relied on reported heights and weights (instead of direct measurement) Forshee and Storey (2003) found no such association. Also, Laurson *et al.* (2008) found that cross-sectional and longitudinal correlations between physical activity, screen time (time spent watching television or playing video games), diet, and BMI were low and non-significant. So, although many studies show sound evidence that there is a link between nutritional habits and childhood obesity the magnitude of such a link is not consensual.

Few studies have computed the change in probability of obesity by varying soft drink consumption. In an application to 385 children aged 11 to 13, Giammattei *et al.* (2003) observed that those who consumed more than three soft drinks per day were more likely to be overweight (have a BMI over the 85th percentile) than those who consumed less than three (58.1% versus 33.2%). This study reveals that the revision of parents' expec-

tations are in line with the clinical data. However, if we assume that parents believe that more than 3 soft drinks a day represents a high consumption, then parents are underestimating the effect of soft drinks on the probability that their child becomes obese in the next 12 months. According to Table 3.8, for a medium level of exercise, parents perceive that children who consume a high level of soda are more likely to become overweight in the next 12 months than those who consume a medium level (30% versus 48%). This reveals that, regarding the impact of soft drinks, parents' expectations are qualitatively well adjusted.

Several studies have demonstrated that increased physical activity is associated with decreased BMI in children and adolescents. Berkey *et al.* (2003) examined the association between changes in BMI over one year and same-year changes in self-reported recreational physical activity and in recreational inactivity (television, videotapes, and video games) among 11,887 boys and girls 10 to 15 years of age. After correction for growth- and development-related changes in BMI, an increase in physical activity was associated with decreasing relative BMI for girls and for overweight boys. Trost *et al.* (2003) found a relationship between inactivity and overweightness in preschool-aged boys but not girls. The main problem with the measurement of the association between physical exercise and nutritional status is the intensity of the exercise. Results are likely to depend on the understanding that each individual has of what is light/ moderate / vigorous exercise. Most studies focused on the time spent in physical exercise and few addressed this issue of measuring intensity. A study by Abbott and Davies (2004) involving 47 boys and girls 5 to 10.5 years old, measured total energy expenditure directly by using the double-labeled water technique and calculated basal metabolic rate by using the Schofield equation. It used these measurements to calculate physical activity levels, as follows: physical activity level total energy expenditure/basal metabolic rate. Body fat and BMI were used to estimate body composition and were found to be significantly inversely correlated with physical activity levels.

To evaluate the accuracy of parents' expectations it is important not only to assess the impact of dietary habits and physical exercise in isolation but also to compare the two types of interventions. In one of the few studies comparing both approaches, Vandongen *et al.* (1995) performed a randomized controlled trial of nutrition and fitness programs over a period of about 9 months in which, 1,147 students 10 to 12 years old from 30 schools were allocated to one of five health programs: fitness, fitness + school nutrition, school-based nutrition, school + home nutrition, home-based nutrition, or a control group. The author found a significant reduction in triceps skin-folds [7] in the group receiving the fitness plus school nutrition program as compared with controls. The other five programs, fitness only, school nutrition only, school nutrition plus home nutrition and home nutrition only resulted in no significant reduction in skin-folds or BMI measures.

Overall, the available scientific information indicates that both restricting soft drink consumption and increasing physical exercise decrease the likelihood that a child becomes obese. From that perspective, parents' expectations are qualitatively consistent with the data, especially regarding soft drink consumption, where parents' subjective probabilities of obesity are in line with the clinical data available. Nevertheless, it seems that parents are giving more importance to the energy intake as a determinant of soft drink consumption, than to the practice of physical exercise.[8]. This suggests the need to promote the correct balance between energy intake and expenditure and to focus on more than just the sugar-added beverages.

[7] Childhood obesity can also be measured by the triceps skinfold thickness (TSF), according to which the 85th and 95th percentiles of TSF are often used to define obesity and super-obesity, Must *et al.* (1991)

[8] Also the introduction of soda-taxes, discussed recently by Fletcher *et al.* (2011) and Gustavsena and Rickertsen (2011), have strengthened the idea that reducing soft drink consumption is important in preventing childhood obesity, which might have increased the weight that parents assign to soft drink consumption

## 3.6 Empirical Approach

### 3.6.1 Model Specification

Our objective is to evaluate how parents' subjective expectations and childhood decision power influence parents decisions', which consequently affects the likelihood that the child becomes obese. According to our motivation and the empirical evidence we have found, through the correlation analysis, parents' decisions regarding the type and amount of food the child is allowed to consume and the times he or she does physical exercise, are likely to affect the propensity to become obese. We focus on two choice variables: the sugar intake (measured by the frequency with which the child consumes sweetened drinks) and the number of times the child does physical exercise. We posit that parents choose first the exercise level of the child, which depends on whether the parent perceives the child to be overweight, on the tendency that the child has to become overweight, and on the exercise level that the parent does (to capture the importance that parents assign to physical exercise). This assumption seems to be realistic if we consider that, in the beginning of the school year, parents must enrol their sons or daughters in extra-curricular activities such as team-sports. After choosing the exercise level, the parent adapts the soft drink consumption accordingly, in order to influence the likelihood that the child does not become overweight in the next period. Our econometric specification is given by:

$$E_{i,s} = \alpha_0 + \alpha_1 H_c^P + \alpha_2 E_P + \alpha_3 \theta + \alpha_4 X + f_s + \epsilon_{i,s} \tag{3.1}$$

$$S_{i,s} = \beta_0 + \beta_1 H_c^P + \beta_2 D + \beta_3 H_c^P D + \beta_4 E_{i,s} + \beta 5 \triangle Prob(H_c = 1 | S, \overline{E}) + \beta_6 X + f_s + \epsilon_{i,s} \tag{3.2}$$

where:

- $E_{i,s}$ is the exercise level that children $i$ from school $s$ does on a weekly basis. It is measured by a dummy variable that equals 1 if the level of exercise the child performs is above the median and 0 if it is below.

- $H_c^P$ is the perception that the parent has regarding the nutritional status of the

child. It is measured by a binary variable that equals 1 if the parent perceives the child to be overweight and 0 otherwise.

- $E_P$ is the number of times the parent does physical exercise on a weekly basis
- $\theta$ measures the tendency that the child has to gain weight and is proxied by the nutritional status of the parent.
- $S_{i,s}$ stands for the consumption of sodas from child $i$ who goes to school $s$.
- $D$ is the decision-making index over the consumption decisions in the household. It ranges from 1, where the child has total control over the type and quantity of soft drinks purchased, to 10, where parents assume the full control.
- $\triangle Prob(Y_{ij} = 1|S, \overline{E})$ represents the change in the probability of obesity by shifting from no consumption to total consumption of soft drinks conditioned on the exercise level chosen previously
- $X$ is a control vector that includes the household income and the gender of the child.

Regression also includes school fixed effects ($f_s$). Assuming a linear specification the results are estimated according to the Ordinary Least Squares model and standard errors are robust and clustered at the school level.

Results are presented in Table 3.9. Regarding the level of exercise, results show that there are only two factors that are determinant: (1) the nutritional status of the parent and (2) the school fixed effects. The former shows that parents who believe themselves to be overweight tend to have children who do more physical activity. This suggests that by believing their children to have a genetic tendency to gain weight, parents seek to prevent it by encouraging physical exercise activities. Although not shown, the significance of the latter might signal that parents rely on schools to provide this kind of activity.

Concerning the level of soft drinks, the results are as expected. The higher the decision power of the parents, the lower is the consumption of soft drinks. If we interpret the 1-to-10 index as the share of decision power (in percentage terms) that each part has,

parents who have an extra 10% of power within the household, will have children who drink 0.1 fewer soft drinks per week. These results are even stronger if parents perceive their children to be overweight, where soft drink consumption falls by 0.21 per week. Results point toward the conclusion that, on average, the greater is the parents' belief in the increase of probability of childhood obesity by shifting soft drink consumption from low to high, the fewer sodas their children will be allowed to consume. More specifically, if the perceived change in the probability increases from 1% (25th percentile) to 5% (75th percentile), the expected reduction in soft drink consumption is of 0.04 drinks per week. If we break down this result by the chosen exercise level, a children who has a high level of physical exercise activity decreases the consumption of sodas by 0.4 on a weekly basis, whereas parents of those who have a value of physical exercise below the median impose a decrease of only 0.03.

Overall, these results suggest that parents who are better informed about the damaging effects of soft drink consumption as well as those who have greater decision power in the household have more responsible behaviors regarding the consumption of sugar-added beverages by their children.

We acknowledge that there are some limitations in our analysis that should be object of future work and rely on the collection of richer data. Firstly, we assumed that the decision about physical exercise was made prior to the decision regarding soft drink consumption. Although it looks plausible, it might be that parents also adapt physical exercise throughout the academic year. The identification of this simultaneous behavior would require higher-frequency data. Also, there might be some endogeneity in beliefs, as unobserved heterogeneoty may influence both beliefs formation and behavior. Panel data may help to mitigate this issue.

## *3.7 Conclusion*

In the last decades childhood obesity has risen to the level of epidemic, becoming a major issue in the health policy debate. Like many developed countries, Portugal has witnessed an exponential increase in the proportion of overweight children and adolescents. In order

to design efficient policies to reverse this dramatic trend, it is urgent to understand the causes that are driving it.

When discussing childhood obesity, the main decision-makers are the parents, who decide the majority of energy intake and expenditure of their children. They will likely base their nutrition and physical exercise decisions on their subjective belief of how they will affect the likelihood that their child becomes obese, and on the power they have to make such decisions.

Collecting a unique dataset in Portugal, we were able to identify these two determinants of consumption decisions, by eliciting the subjective probabilities that parents assign to childhood obesity conditional on a set of energy intake and expenditure mix, and the decision-making power distribution within the household. We find that parents have accurate expectations concerning the impact of increasing soft drink consumption or decreasing physical exercise on the probability that the child becomes obese. However, parents believe that restricting sugar-added beverages intake is more efficient than fighting a sedentary lifestyle in preventing childhood obesity.

Moreover, our results suggest that, the greater that parents perceive to be the increase in the probability of obesity by increasing soft drink consumption, the lower will be the consumption of soft drinks from their children. Also, parents who typically have a higher share in the decision-making process in the household will also place higher restrictions on the consumption of sweetened beverages, which has been proven to influence the propensity that the child becomes obese.

Our findings enlighten the policy making debate in two ways. On the one hand, mass-media campaigns should reinforce the responsibility that parents have in making the consumption decisions. On the other hand, our elicitation shows that parents are undervaluing the impact that physical exercise can have. Policies such as promoting children's marathons associated with childhood anti-obesity campaigns might alert parents to the importance of an active life.

# BIBLIOGRAPHY


Abbott, R. and Davies, P. (2004). Habitual physical activity and physical activity intensity: their relation to body composition in 5.0 to 10.5 - y - old children. *European Journal of Clinical Nutrition*, **58**, 285–291.

Anderson, P., Butcher, K. and Levine, P. B. (2003). Maternal employment and overweight children. *Journal of Health Economics*, **22**, 477–504.

Berkey, C., Rocket, H., Gillman, M. and Colditz, G. A. (2003). One-year changes in activity and inactivity among 10-to 15-year-old boys and girls: relationship to change in Body Mass Index. *Pediatrics*, **111**, 836–843.

—, Rockett, H., Field, A., Gillman, M. and Colditz, G. (2004). Sugar-added beverages and adolescent weight change. *Obesity Research*, **12**, 778–788.

Bethell, C., Simpson, L., Stumbo, S., Carle, A. C. and Gombojav, N. (2010). National, state, and local disparities in childhood obesity. *Health Affairs*, **29**, 347–356.

Cawley, J. (2010). The economics of childhood obesity. *Health Affairs*, **29** (3), 364–371.

—, Moran, J. and Simon, K. (2010). The impact of income on the weight of elderly americans. *Health Economics*, **19** (8), 979–993.

De La O A, M.-M., L.J., O., Jordan, K., Mihalopoulos, K., Heap, N., Carlson, E., Cox, E., Friedrichs, R. M. and Stoddard, G. (2009). Do parents accurately perceive their child's weight status? *Journal of Pediatric Health Care*, **23**, 216–21.

Delavande, A. (2008). Pill, patch or shot? subjective expectations and birth control choice. *International Economic Review*, **49**, 999–1042.

— and Kohler, H.-P. (2009). Subjective expectations in the context of hiv/aids in malawi. *Demographic Research*, **20**, 817–874.

— and Rohwedder, S. (2011). Individuals uncertainty about their future social security benefits and portfolio choice. *Journal of Applied Econometrics*, **26**.

Dominitz, J. and Manski, C. F. (1996). Eliciting student expectations of the returns to schooling. *The Journal of Human Resources*, **31**, 1–26.

Eckstein, K. C., Mikhail, K., Ariza, A. J., Thomson, J., S., S. C., Millard and Binns, H. (2006). Parent's perceptions of their child's weight and health. *Pediatrics*, **117**, 681–690.

Evans, A. and He, M. (2007). Are parents aware that their children are overweight or obese? *Canadian Family Physician*, **53**, 1493–1499.

Fertig, A., Glomm, G. and Tchernis, R. (2009). The connection between maternal employment and childhood obesity: inspecting the mechanisms. *Review Of Economics Of The Household*, **7**, 227–255.

Fisher, J. and Fisher, W. (1992). Changing aids risk behaviors. *Psychological Bulletin*, **111**, 455474.

Fletcher, J., Frisvold, D. E. and Tefft, N. (2011). Are soft drink taxes an effective mechanism for reducing obesity? *Journal of Policy Analysis and Management*, **30** (3), 655662.

Forshee, R. and Storey, M. (2003). Total beverage consumption and beverage choices among children and adolescents. *International Journal of Food Science*, **54**, 297–307.

Frieden, T., Dietz, W. and Collins, J. (2010). Reducing childhood obesity through policy change: Acting now to prevent obesity. *Heal*, **29**, 357–363.

Giammattei, J., Blix, G., Marshak, H., Wollitzer, A. and Pettitt, D. (2003). Television watching and soft drink consumption: associations with obesity in 11-to-13-year-old schoolchildren. *Archives of Pediatric and Adolescent Medicine*, **157**, 882–6.

Golan, M. (2006). Parents as agents of change in childhood obesity from research to practice. *International Journal of Pediatric Obesity*, **1** (2), 66–76.

Gomes, S., Espanca, R., Gato, A. and Miranda, C. (2010). Obesidade em idade pre-escolar cedo demais para pesar demais! *Acta Medica Portuguesa*, **23**, 371–378.

Gustavsena, G. W. and Rickertsen, K. (2011). The effects of taxes on purchases of sugar-sweetened carbonated soft drinks: a quantile regression approach. *Applied Economics*, **43** (6), 707–716.

Intagliata, V., Ip, E., Gesell, S. and Barkin, S. (2008). Accuracy of self- and parental perception of overweight among latino preadolescents. *North Carolina Medical Journal*, **69**, 88–91.

James, D., J.and Kerr (2005). Prevention of childhood obesity by reducing soft drinks. *International Journal of Obesity*, **29**, 54–57.

Janssen, I., Katzmarzyk, P., Boyce, W., Vereecken, C., Mulvihill, R. C., C., Currie, C. and Pickett, W. (2005). Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. *Obesity Reviews*, **6**, 123132.

Laurson, K., Eisenmann, J. and Moore, S. (2008). Lack of association between television viewing, soft drinks, physical activity and body mass index in children. *Acta Paediatric*, **97**, 795–800.

Lindsay, A., Sussner, K. M., Kim, J. and Gortmaker, S. (2006). The role of parents in preventing childhood obesity. *The Future of Children*, **16** (1), 169–186.

Lobstein, T., Baur, L. and Uauy, R. (2004). Obesity in children and young people: a crisis in public health. *Obesity Reviews*, **5**, 485.

Maia, J. and Sousa, M. (2005). *Crescimento somatico, actividade fisica e aptidão fisica associada à saude: Um estudo populacional nas crianças do 1 ciclo*. Sa-Artes Graficas.

Manski, C. (2004). Measuring expectations. *Econometrics*, **72**, 1329–1376.

Mota, J., Flores, L., Ribeiro, J. and Santos, M. (2006). Relationship of single measures of cardiorespiratory fitness and obesity in yound schoolchildren. *American Journal of Human Biology*, **18**, 335–341.

Must, A., Dallal, G. and Dietz, W. (1991). Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht2) and triceps skinfold thickness. *American Journal of Clinical Nutrition*, **54**, 839–846.

Nicklas, T., Yang, S., Baranowski, T., Zakeri, I. and Berenson, G. (2003). Eating patterns and obesity in children. the Bogalusa Heart Study. *American Journal of Preventive Medicine*, **25**, 9–16.

Ogden, C., Carroll, M., Curtin, L., Lamb, M. and Flegal, K. (2010). Prevalence of high Body Mass Index in US children and adolescents, 2007-2008. *The Journal of the American Medical Association*, **303**, 242–249.

Padez, C., Fernandes, T., Moreira, P. and Rosado, V. (2004). Prevalence of overweight and obesity in 7-9-y old Portuguese children. trends in Body Mass Index from 1970 to 2002. *American Journal of Human Biology*, **16**, 670–678.

Philipson, T. (2001). The world-wide growth in obesity: an economic research agenda. *Health Economics*, **10**, 1–7.

— and Posner, R. (1993). *Private Choices and Public Health: The AIDS Epidemic in an Economic Perspective*. Cambridge: Harvard University Pres.

Powell, L. M. (2009). Fast food costs and adolescent Body Mass Index: Evidence from panel data. *Journal of Health Economics*, **28** (5), 963–970.

Raschad, I. and Christian, T. J. (2009). Trends in U.S. food prices, 1950-2007. *Economics and Human Biology*, **7** (7), 113–120.

Rito, A. (2006). Overweight and obesity in the preschool children of Coimbra. *Obesity Reviews*, **7**, 366.

Sassi, F. (2010). *Obesity and the Economics of Prevention Fit not Fat*. Tech. rep., OECD.

Schmeiser, M. D. (2009). Expanding wallets and waistlines: The impact of family income on the BMI of women and men eligible for the earned income tax credit. *Health Economics*, **18**, 1277–1294.

Scholder, S. (2008). Maternal employment and overweight children: Does timing matter? *Health Economics*, **17**, 889–906.

Sousa, B., Oliveira, B. and Almeida, M. (2006). Assessment of nutritional status in 6- to 10-years.old children of the Autonomous Region of Madeira, Portugal. *Public Health Nutrition*, **9**, 109.

Troiano, R., Briefel, R., Carroll, M. and Bialostosky, K. (2000). Energy and fat intakes of children and adolescents in the United States: data from the National Health and Nutrition Examination Surveys. *American Journal of Clinical Nutrition*, **72 (suppl)**, 1343S–1353S.

Trost, S., Sirard, J., Dowda, M., Pfeiffer, K. and Pate, R. (2003). Physical activity in overweight and nonoverweight preschool children. *International Journal of Obesity Related Metabolic Disorders*, **27**, 834–839.

Vandongen, R., Jenner, D. A., Thompson, C., Taggart, A. C., Spickett, E., Burke, V., Beilin, L. J., Milligan, R. A. and Dunbar, D. L. (1995). A controlled evaluation of a fitness and nutrition intervention program on cardiovascular health in 10- to 12-year-old children. *Prevention Medicine*, **24**, 9–22.

Wald, E., Ewing, L., Cluss, P., Goldstrohm, S., Cipriani, L., Colborn, D. and Weissfeld, L. (2007). Parental perception of childrens weight in a paediatric primary care setting. *Child: care, health and development*, **33**, 738743.

You, W. and Davis, G. C. (2007). *Agricultural and Applied Economics Association Series 9737*. u in.

*Tab. 3.1:* Descriptive Statistics

| | Proportion or mean |
|---|---|
| **Parent** | |
| **Gender** | |
| Women | 83.64 |
| Men | 16.36 |
| **Age** | 40 |
| | (4.96) |
| **Education** | |
| Primary Schooling | 0.46 |
| Secondary Schooling | 10.05 |
| University Degree | 73.52 |
| Master Degree or Higher | 15.98 |
| **Marital Status** | |
| Single | 3.21 |
| Divorced / Separated | 11.01 |
| Married / Living Together | 84.86 |
| Widowed | 0.46 |
| **Number of Children** | 2.11 |
| | (1.01) |
| **Income of the household (monthly, in Euro, after taxes)** | |
| Less than 500 | 0.99 |
| 500 - 1500 | 5.45 |
| 1500 - 2500 | 19.80 |
| 2500 - 3500 | 32.18 |
| 3500 - 5000 | 22.77 |
| More than 5000 | 18.81 |
| **Children** | |
| **Gender** | |
| Girl | 54.09 |
| Boy | 45.91 |
| **Age** | 7.81 |
| | (0.67) |
| **Observations** | 220 |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.2:* Nutritional Status

| | Proportion or mean |
|---|---|
| **Parent** | |
| **BMI** | 22.68 |
| | (3.23) |
| **Nutritional Status** | |
| Underweight | 6.82 |
| Normal weight | 66.82 |
| Overweight | 23.64 |
| Obese | 2.73 |
| **Children** | |
| **BMI** | 16.43 |
| | (2.43) |
| **Nutritional Status** | |
| Underweight | 8.62 |
| Normal weight | 75.86 |
| Overweight | 10.92 |
| Obese | 4.60 |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.3:* Parent Perception of Nutritional Status

| | Proportion or mean |
|---|---|
| **Categorical Self Perception** | |
| Very Underweight | 0.92 |
| Slightly Underweight | 14.22 |
| Normal Weight | 50.00 |
| Slightly Overweight | 31.65 |
| Very Overweight | 3.21 |
| **Categorical Perception of the Child** | |
| Very Underweight | 3.20 |
| Slightly Underweight | 25.11 |
| Normal Weight | 62.56 |
| Slightly Overweight | 8.68 |
| Very Overweight | 0.46 |
| **Visual Perception of the Child** | |
| Below the median | 82.08 |
| At the median | 15.09 |
| Over the median | 2.84 |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.4:* Employment Status and Time Allocation

| | Proportion or mean |
|---|---|
| **Currently Employed** | 90.28 |
| **Spouse Currently Employed** | 95.79 |
| **Performs housework** | 95.35 |
| **Spouse Performs housework** | 86.17 |
| | |
| **Weekday Time Allocation (in minutes)** | |
| Work | 489.12 |
| | (257.84) |
| Housework | 73.52 |
| | (78.19) |
| Cook | 51.49 |
| | (54.06) |
| Child | 165.25 |
| | (164.45) |
| Leisure | 54 |
| | (45.01) |
| **Spouse Weekday Time Allocation (in minutes)** | |
| Work | 597.37 |
| | (588.66) |
| Housework | 41.36 |
| | (93.72) |
| Cook | 22.43 |
| | (31.44) |
| Child | 126.19 |
| | (132.96) |
| Leisure | 64.76 |
| | (57.28) |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.5:* Income Allocation

| | Proportion or mean |
|---|---|
| **Spent on Vegetables** | 113.68 |
| | (75.41) |
| **Spent on Sugar** | 31.82 |
| | (28.41) |
| **Spent on Fat** | 13.48 |
| | (17.22) |
| **Spent on House Bills** | 282.42 |
| | (215.79) |
| **Spent on Education** | 922.18 |
| | (481.70) |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.6:* Exercise and Nutrition Habits

| | Proportion or mean |
|---|---|
| **Exercise Habits** | |
| **Parents Exercise** | 50.92 |
| **Times Parents Exercise per week** | 2.40 |
| | (1.08) |
| **Children Exercise** | 98.18 |
| **Times Children Exercise per week** | 2.89 |
| | (1.23) |
| **Nutrition Habits** | |
| **Family has dinner together** | |
| Daily | 77.21 |
| Between 4 and 5 times per week | 10.70 |
| Between 2 and 3 times per week | 11.63 |
| Once per week | 0 |
| Less than 1 time per week | 0.47 |
| **Child eats fruit** | |
| Less than 1 per week | 0.47 |
| Between 1 and 3 per week | 6.10 |
| Between 4 and 7 per week | 20.66 |
| Between 8 and 10 per week | 26.76 |
| More than 10 per week | 46.01 |
| **Child eats vegetables** | |
| Less than 1 per week | 1.42 |
| Between 1 and 3 per week | 7.55 |
| Between 4 and 7 per week | 23.58 |
| Between 8 and 10 per week | 18.87 |
| More than 10 per week | 48.58 |
| **Child drinks soft drinks** | |
| Less than 1 per week | 43.12 |
| Between 1 and 3 per week | 39.91 |
| Between 4 and 7 per week | 16.06 |
| Between 8 and 10 per week | 0.46 |
| More than 10 per week | 0.46 |
| **Child eats sweets** | |
| Less than 1 per week | 15.67 |
| Between 1 and 3 per week | 50.23 |
| Between 4 and 7 per week | 27.19 |
| Between 8 and 10 per week | 4.15 |
| More than 10 per week | 2.76 |
| **Child eats high-fat snacks** | |
| Less than 1 per week | 55.91 |
| Between 1 and 3 per week | 37.63 |
| Between 4 and 7 per week | 5.91 |
| Between 8 and 10 per week | 0.54 |
| More than 10 per week | 0 |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.7:* Child's Decision Power

| | Proportion or mean |
|---|---|
| **Times Child Expresses Consumption Wishes** | |
| Never | 1.39 |
| Rarely | 8.80 |
| Seldom | 37.04 |
| Frequently | 43.06 |
| Always | 9.72 |
| **Times Parents say Yes to Child's Wishes** | |
| Never | 1.40 |
| Rarely | 14.02 |
| Seldom | 65.89 |
| Frequently | 17.29 |
| Always | 1.40 |
| **Times Child goes Shopping** | |
| Never | 3.70 |
| Rarely | 27.31 |
| Seldom | 34.26 |
| Frequently | 30.56 |
| Always | 4.17 |
| **Decision-Power Distribution** | |
| Decision about sweets | 8.79 |
| | (1.50) |
| Decision about sodas | 9.16 |
| | (1.31) |
| Decision about vegetables | 9.48 |
| | (1.26) |
| Decision about fruits | 8.92 |
| | (1.76) |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.8:* Joint Conditional Probabilities of Child Obesity in 12 months

| | **Low Soft Drinks** | **Medium Soft Drinks** | **High Soft Drinks** |
|---|---|---|---|
| **Low Exercise** | 21.74 | 42.71 | 64.35 |
| | (20.18) | (26.47) | (34.62) |
| **Medium Exercise** | 12.48 | 29.63 | 47.51 |
| | (13.00) | (19.64) | (27.92) |
| **High Exercise** | 4.55 | 18.40 | 34.18 |
| | (6.61) | (17.47) | (25.56) |

Proportion or average (with standard deviation in parentheses, when applicable)

*Tab. 3.9:* Exercise Level and Soft Drink Consumption

| | (1) Exercise Level | (2) Soft Drink |
|---|---|---|
| Parent sees child | -0.06 | 1.20** |
| as overweight | (0.25) | (0.43) |
| Parent does much | 0.02 | |
| exercise | (0.08) | |
| **Nutritional Status Parent** | | |
| Adequate Weight | 0.49*** | |
| | (0.04) | |
| Slightly Overweight | 0.44*** | |
| | (0.09) | |
| Very Overweight | 0.99*** | |
| | (0.09) | |
| Income | | |
| Less than 2500 Euros | -0.34 | 0.14 |
| | (0.19) | (0.13) |
| 2500 - 3500 Euros | -0.33 | 0.08 |
| | (0.19) | (0.05) |
| More than 3500 Euros | -0.3 | 0.01 |
| | (0.24) | (0.05) |
| Boy Child | -0.02 | 0.07 |
| | (0.13) | (0.06) |
| Decision Index Soft Drinks | | -0.10** |
| | | (0.04) |
| Parent sees child as overweight * | | -0.11** |
| Decision Index Soft Drinks | | (0.04) |
| Chosen Exercise Level | | -0.04 |
| | | (0.06) |
| $\Delta Prob(H_i = 1\|S, \overline{E})$ | | -0.01* |
| | | (0.00) |
| Constant | 1.30** | 1.04** |
| | (0.28) | (0.33) |
| Observations | 100 | 112 |

Standard errors in parentheses, clustered at the School Level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

School Fixed effects Included

*Fig. 3.3:* Distribution of the Unconditional Probability of Child Obesity in 12 months

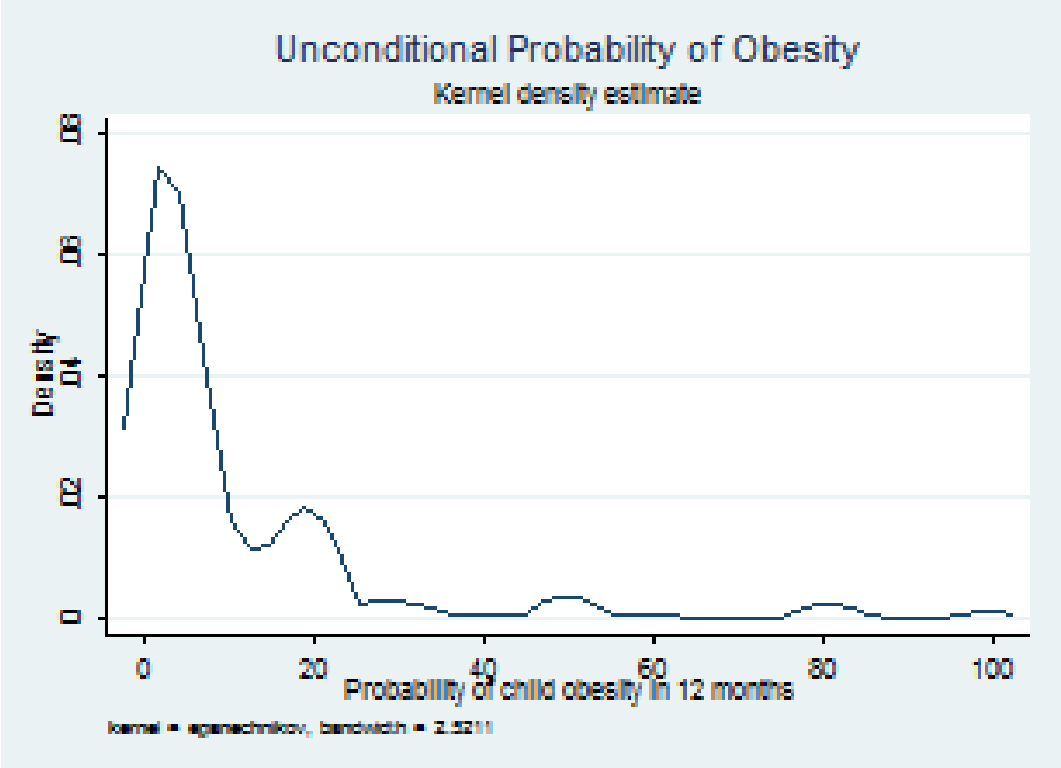



*Fig. 3.4:* Distribution of the Conditional Probability of Child Obesity in 12 months

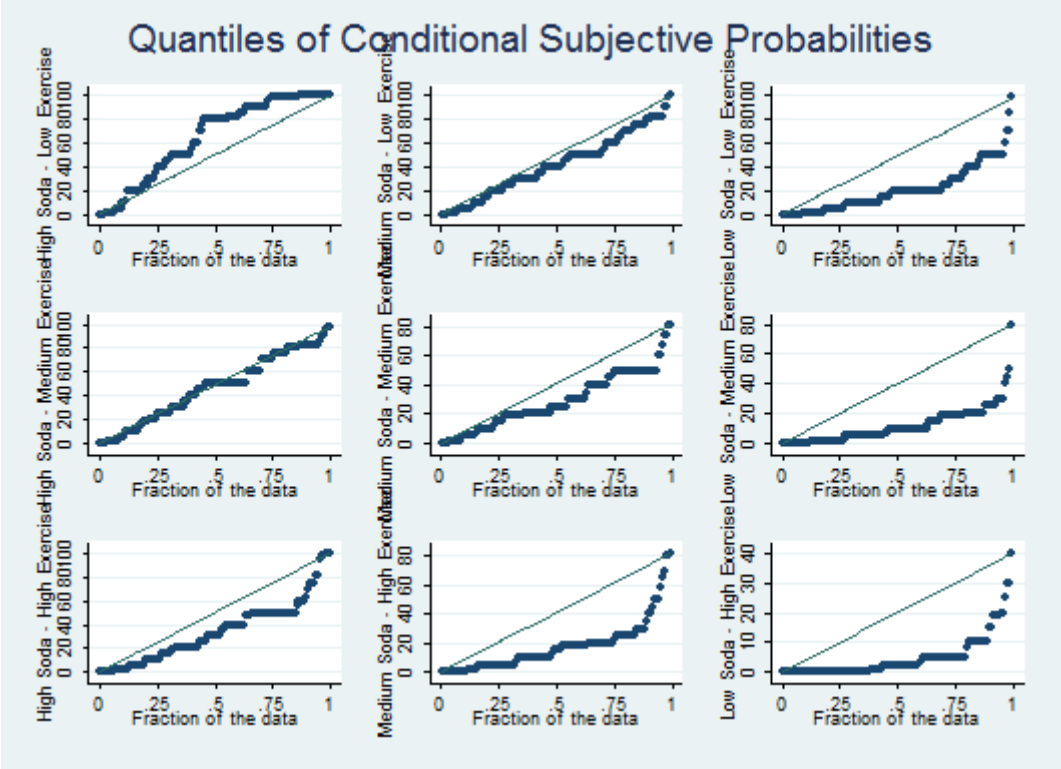


*Fig. 3.5:* Distribution of the Conditional Probability of Child Obesity in 12 months by Gender of Parent

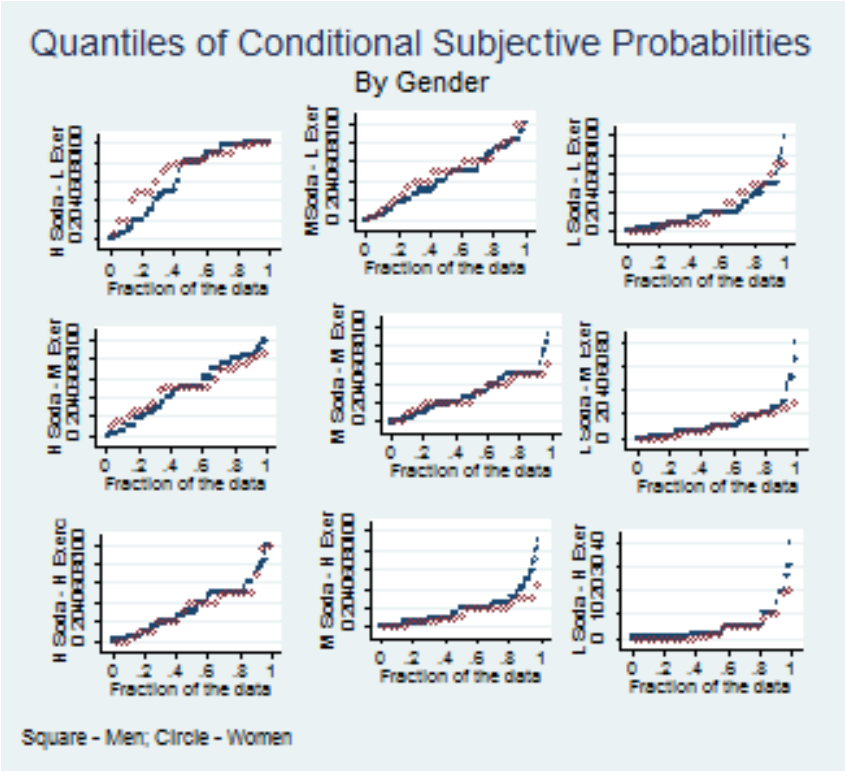



*Fig. 3.6:* Distribution of the Conditional Probability of Child Obesity in 12 months by Age of Child

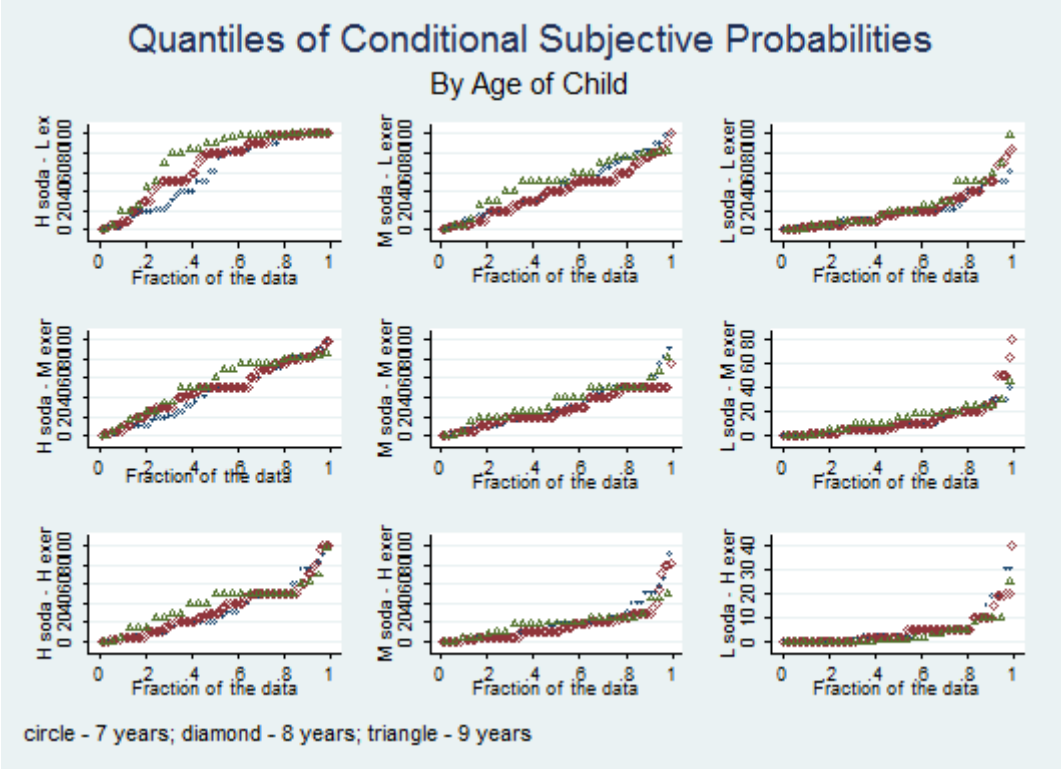


*Fig. 3.7:* Distribution of the Conditional Probability of Child Obesity in 12 months by Nutritional Status of Parent

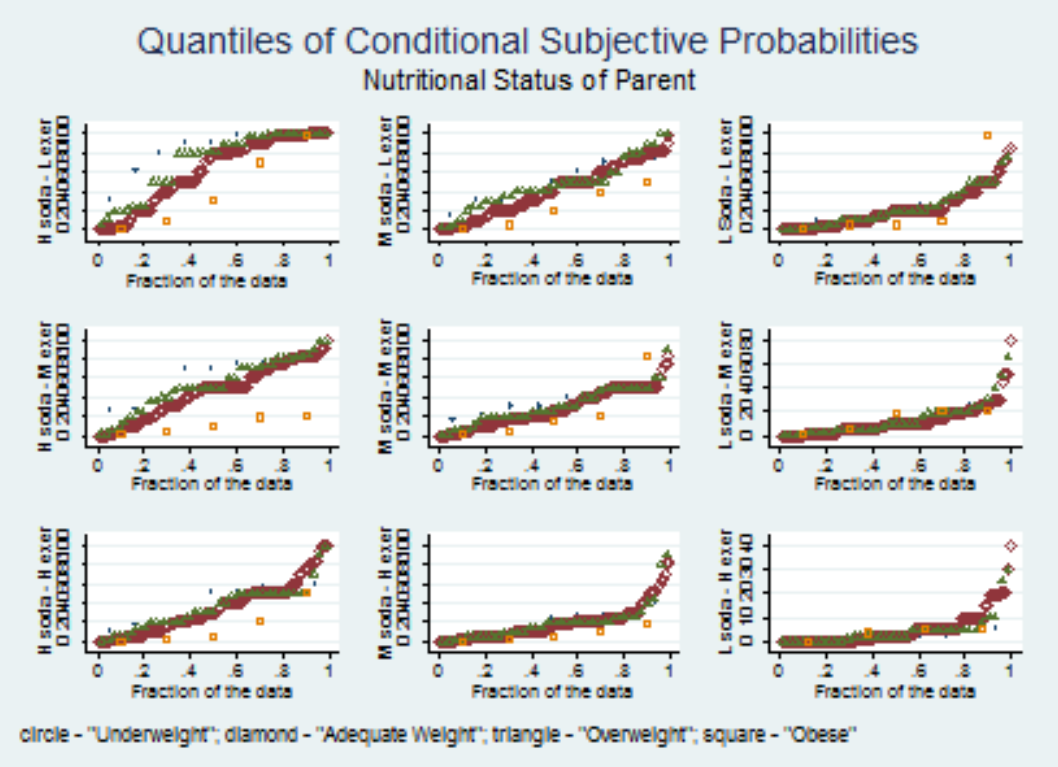
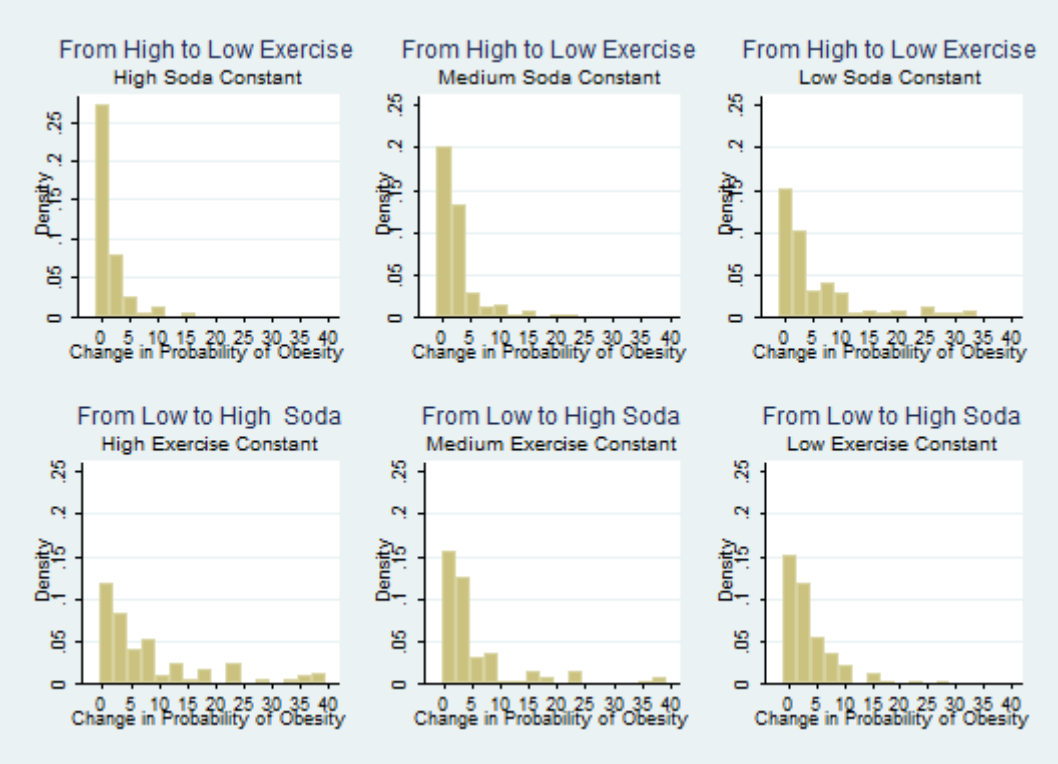



*Fig. 3.8:* Distribution of the Change Conditional Probability of Child Obesity in 12 months



## *3.A Appendix*

*Fig. 3.9:* Visual Scale for Boys

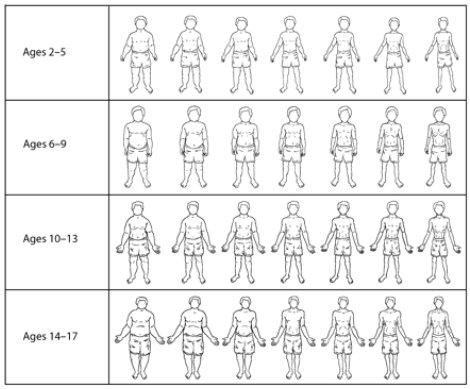
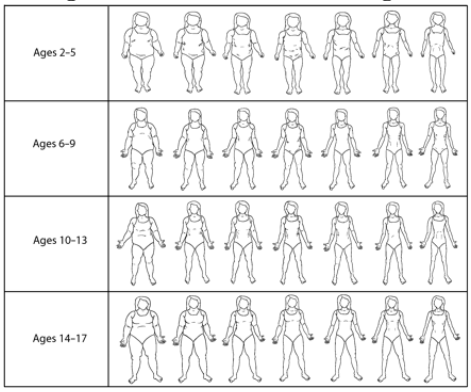



*Fig. 3.10:* Visual Scale for girls



**A OBESIDADE INFANTIL EM PORTUGAL, 2011**
***QUESTIONÁRIO AOS ENCARREGADOS DE EDUCAÇÃO***

*O OBJECTIVO DO ESTUDO É AVALIAR OS DETERMINANTES DA OBESIDADE INFANTIL EM PORTUGAL*
*AGRADEÇO A MAIOR SINCERIDADE NAS RESPOSTAS.*
*TODAS AS INFORMAÇÕES SÃO ESTRITAMENTE CONFIDENCIAIS, NÃO SENDO OS SUJEITOS IDENTIFICADOS EM QUAISQUER CIRCUNSTÂNCIA E OS DADOS RECOLHIDOS SERÃO UTILIZADOS EXCLUSIVAMENTE PARA FINS ACADÉMICOS.*
*A CRIANÇA A QUE SE REFERE O ESTUDO DEVE FREQUENTAR O 2º OU 3º ANO DO ENSINO PRIMÁRIO (1º CICLO ENSINO BÁSICO)*

| **IDENTIFICAÇÃOC** |
|---|
| CODIGO ENCARREGADO DE EDUCAÇÃO: |
| ESCOLA: DATA: ___/___/___ |

| **A- INFORMAÇÃO SOCIODEMOGRÁFICA DO ENCARREGADO DE EDUCAÇÃO** | |
|---|---|
| A1 – SEXO | 1. FEMININO<br>2. MASCULINO |
| A2 - IDADE | ANOS |
| A3 - NÍVEL DE EDUCAÇÃO | 1. SEM ESCOLARIDADE<br>2. ENSINO PRIMÁRIO<br>3. ENSINO SECUNDÁRIO<br>4. LICENCIATURA<br>5. MESTRADO OU SUPERIOR |
| A4 – ESTADO CIVIL | 1. SOLTEIRO<br>2. DIVORCIADO / SEPARADO<br>3. VIUVO<br>4. CASADO / UNIÃO DE FACTO |
| A5 – QUANTOS FILHOS TEM? | |
| A6 – QUAL A IDADE DOS SEUS FILHOS? | 1.<br>2.<br>3.<br>4.<br>5.<br>6. |
| A7 - QUAL É O RENDI MENTO MENSAL MÉDIO DO SEU AGREGADO FAMILIAR (DEPOIS DE IMPOSTOS)? | 1. <500€<br>2. 500-1500€<br>3. 1500-2500€<br>4. 2500-3500€<br>5. 3500-5000€<br>6. >5000€ |

| **B- NUTRIÇÃO E SAÚDE DO ENCARREGADO DE EDUCAÇÃO** | |
|---|---|
| B1 – QUANTO É QUE PESA? (EM KG) | |
| B2 – QUANTO É QUE MEDE? (EM CM) | |
| B3 – PRATICA EXERCÍCIO FÍSICO? (CONSIDERA-SE EXERCÍCIO FÍSICO ACTIVIDADES DE ESFORÇO MODERADO COMO CORRER , NADAR, EXERCÍCIO AERÓBICO, DESPORTOS EM GRUPO , POR MAI S DE 30 MINUTOS CONSECUTIVOS) | 1. SIM<br>2. NÃO |
| B4 – QUANTAS VEZES POR SEMANA PRATICA EXERCÍCIO FÍSICO? | |

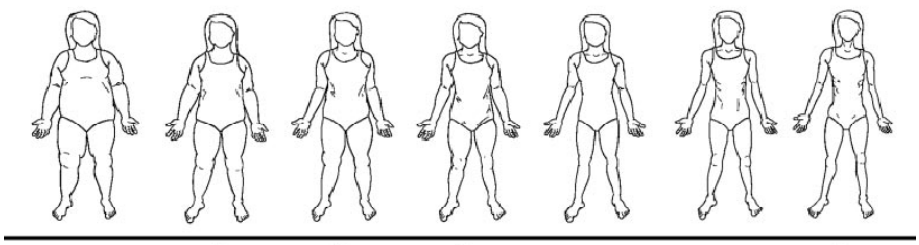
*(A CRIANÇA EM QUESTÃO NA SECÇÃO SEGUINTE É A REFERIDA NO INÍCIO DO INQUÉRITO)*

| **C- NUTRIÇÃO E SAÚDE DA CRIANÇA** | |
|---|---|
| C1 – O/A SEU/SUA FILHO/A A QUE SE REFERE NO INÍCIO DO INQUÉRITO É UM RAPAZ OU RAPARIGA? | 1. RAPARIGA<br>2. RAPAZ |
| C2 – QUE IDADE TEM O/A SEU/SUA FILHO/A? | ANOS |
| C3 – QUANTO É QUE O/A SEU/SUA FILHO/A PESA? (EM KG) | KG |
| C4 – QUANTO É QUE O/A SEU/SUA FILHO/A MEDE? (EM CM) | CM |
| C5 – O/A SEU/SUA FILHO/FILHA SOFRE DE ALGUMA DOENÇA CRÓNICA?<br><br>EM CASO NEGATIVO SIGA PARA A QUESTÃO C7 | 1. SIM<br>2. NÃO |
| C6– DE QUE DOENÇAS CRÓNICAS SOFRE O/A SEU/SUA FILHO/A? (ESCOLHER TODAS AS QUE SE APLIQUEM) | 1. ASMA<br>2. DIABETES<br>3. INSUFICIÊNCIA CARDÍACA<br>4. COLESTEROL ALTO<br>5. DISTÚRBIO ALIMENTAR<br>1. OUTRO |
| C7 – O/A SEU/ SUA FILHO/A PRATICA EXERCÍCIO FÍSICO? (CONSIDERA-SE EXERCÍCIO FÍSICO ACTIVIDADES DE ESFORÇ O MODERADO C OMO CORRER, NADAR, EXERCÍCIO AERÓBICO, DESPORTOS EM GRUPO , POR MAIS DE 30 MINUTOS CONSECUTIVOS) | 1. SIM<br>2. NÃO |
| C8 – QUANTAS VEZES POR SEMANA O /A SEU/SUA FILHO/A PRATICA EXERCÍCIO FÍSICO? | |

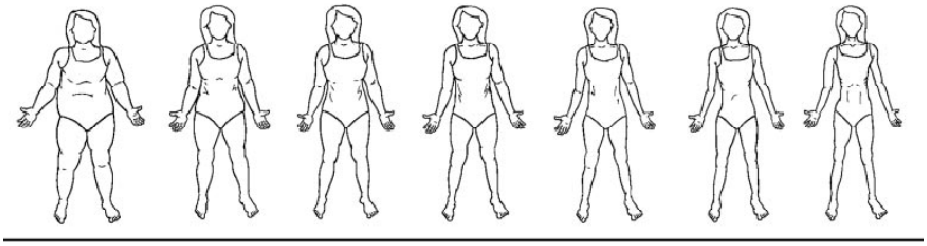
| **D – PERCEPÇÕES** | |
|---|---|
| D1 – DO PONTO DE VISTA FÍS ICO, CONSIDERA-SE UMA PESSOA _____? | 1. MUITO MAGRA<br>2. LIGEIRAMENTE MAGRA<br>3. PESO ADEQUADO<br>4. COM LIGEIRO EXCESSO DE PESO<br>5. COM MUITO EXCESSO DE PESO |
| D2 – EM RELAÇÃO AO/Á SEU/SUA FILHO/A REFERIDA NO INÍCIO DO QUESTIONÁRIO CONSIDERA QUE É UMA CRIANÇA _____? | 1. MUITO MAGRA<br>2. LIGEIRAMENTE MAGRA<br>3. PESO ADEQUADO<br>4. COM LIGEIRO EXCESSO DE PESO<br>5. COM MUITO EXCESSO DE PESO |

D3A – SE O/A SEU/SUA FILHO/A REFERIDO NO INICIO DO QUESTIONÁRIO É UMA RAPARIGA **ASSINALE COM UMA CRUZ (NO QUADRADO CINZENTO RESPECTIVO)** A FIGURA QUE MAIS SE ASSEMELHA COM A SUA CONSTITUIÇÃO FÍSICA, EM FUNÇÃO DA IDADE.

1. SE A SUA FILHA TEM ENTRE 6 E 9 ANOS

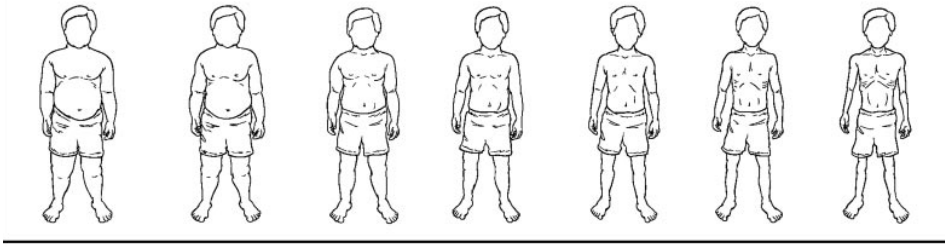


2. SE A SUA FILHA TEM ENTRE 10 E 13 ANOS

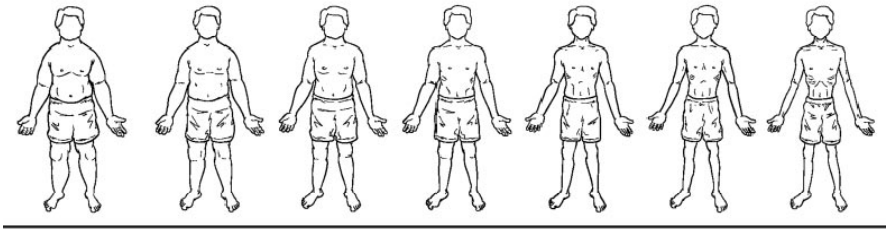


D3B– SE O/A SEU/SUA FILHO/A REFERIDO NO INICIO DO QUESTIONÁRIO É U M RAPAZ **ASSINALE COM UMA CRUZ (NO QUADRADO CINZENTO RESPECTIVO)** A FIGURA QUE MAIS SE ASSEMELHA COM A SUA CONSTITUIÇÃO FÍSICA, EM FUNÇÃO DA IDADE.

1. SE O SEU FILHO TEM ENTRE 6 E 9 ANOS



2. SE O SEU FILHO TEM ENTRE 10 E 13 ANOS

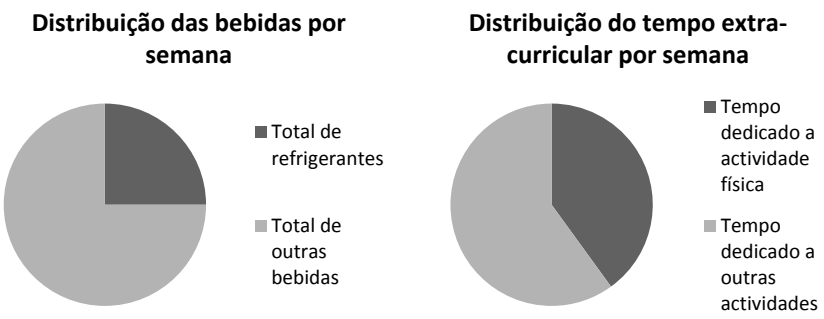


NA PRÓXIMA SECÇÃO VAMOS FAZER ALGUMAS PERGUNTAS SOBRE A PROBABILIDADE DE QUE CERTOS ACONTECIMENTOS OCORRAM. A PROBABILIDADE DEVE SER UM NÚMERO ENTRE 0 E 100. NÚMEROS COMO 2 OU 5% PODEM REPRESENTAR "PRATICAMENTE NENHUMA PROBABILIDADE", 19% REPRESENTA "POUCO PROVÁVEL", 47 OU 50% PODE REPRESENTAR "IGUALMENTE PROVÁVEL", CERCA DE 82% PODE REPRESENTAR "MUITO PROVÁVEL" E 98% PODE INDICAR UMA "PROBABILIDADE QUASE CERTA".

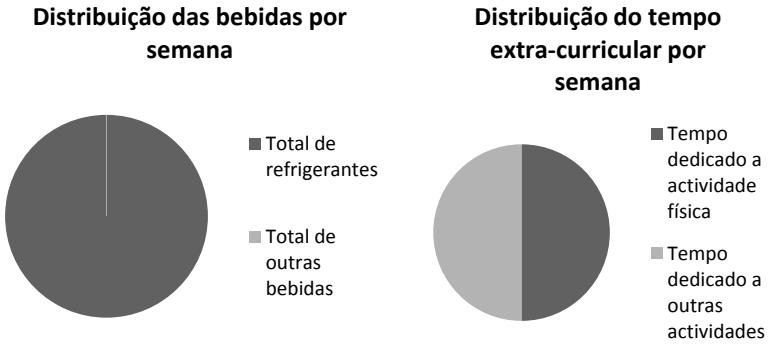
| **E – SITUAÇÕES HIPOTÉTICAS** | |
|---|---|
| E0 (PERGUNTA-TESTE) – QUAL A PROBABILID ADE DE CHOVER AMANHÃ? | |
| E1 – QUAL É A PROBABIL IDADE DO/DA SEU/SUA FILHO/A SER OBESO DAQUI A 12 MESES?<br><br>(EM PERCENTAGEM) | |

NAS PRÓXIMAS QUESTÕES VAMOS IMAGINAR DIFERENTES CENÁRIOS SOBRE O CONSUMO DE BEBIDAS POR PARTE DO SEU FILHO E A FORMA COMO OCUPA O TEMPO EXTRA-CURRICULAR. NOMEADAMENTE, DE CENÁRIO PARA CENÁRIO IREMOS VARIAR:

- A PROPORÇÃO DE REFRIGERANTES (COCA-COLA, ICED-TEA, SPRITE, GUARANÁ…) CONSUMIDOS PELO/A SEU/SUA FILHO/A POR SEMANA FACE À QUANTIDADE TOTAL DE BEBIDAS CONSUMIDAS (LEITE, ÁGUA, SUMOS NATURAIS, CHÁ…)
- PROPORÇÃO DE TEMPO DEDICADO AO EXERCÍCIO FÍSICO PELO/A SEU/SUA FILHO/A FACE AO TOTAL EM AC TIVIDADES NÃO LECTIVAS (VER TELEVISÃO, VIDEOJOGOS, ACTIVIDADES EXTRA-CURRICULARES NÃO RELACIONADAS COM EXERCÍCIO FÍSICO…)

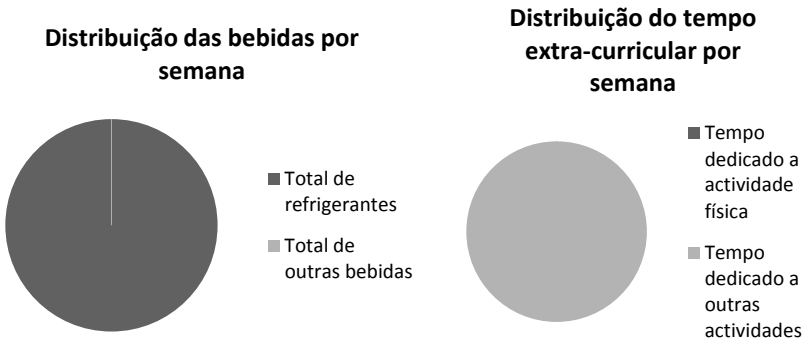



CONSIDERE O SEGUINTE EXEMPLO: SE O/ A SEU/SUA FILHO/A SÓ BEBER REFRIGERANTES E DEDICAR METADE DO TEMPO EXTRA-CURRICULAR EM ACTIVIDADES FÍSICAS AS DISTRIBUIÇÕES DE BEBIDAS E TEMPO SERIAM DADAS POR:



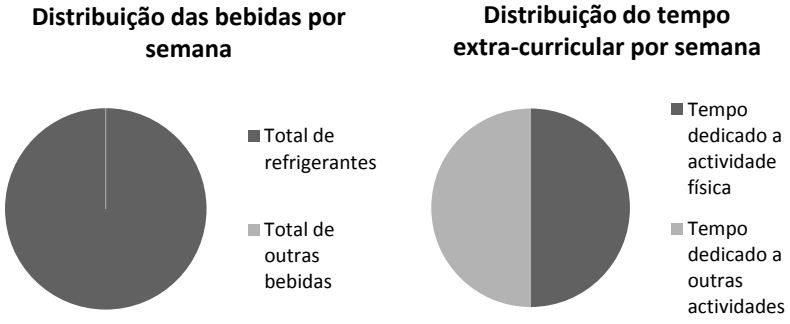

**CONSIDERANDO O EFEITO CO MBINADO DA QUANTIDADE DE REFRIGERA NTES E DO TE MPO DEDICADO A ACTIVIDADES FÍSICAS, QUAL É A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?**

E2- SE A DISTRIBUIÇÃO FOR DADA POR:



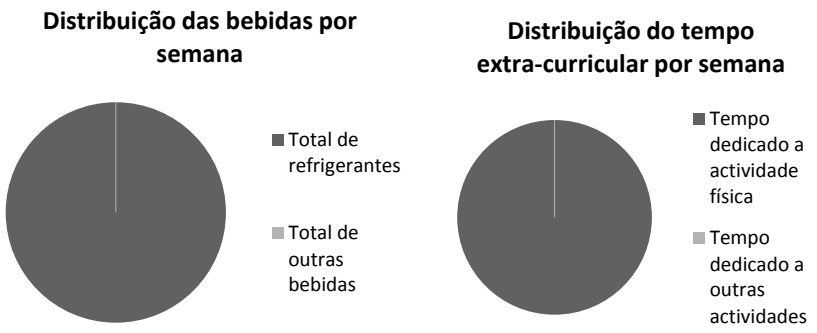

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E3- SE A DISTRIBUIÇÃO FOR DADA POR:



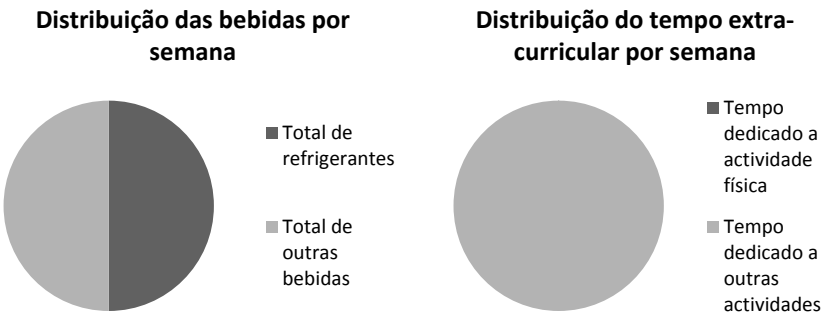

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E4 - SE A DISTRIBUIÇÃO FOR DADA POR:



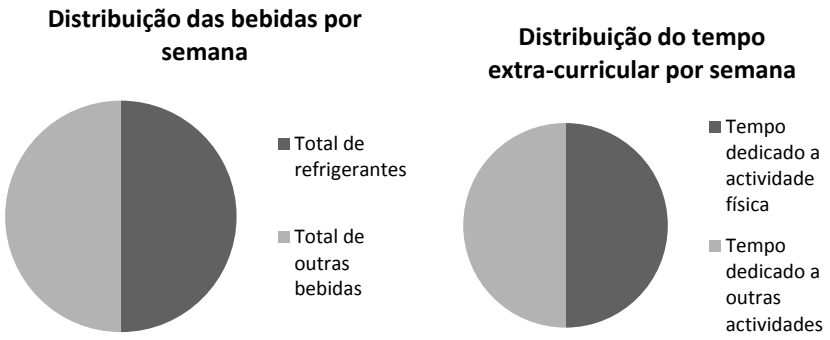

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E5 - SE A DISTRIBUIÇÃO FOR DADA POR:



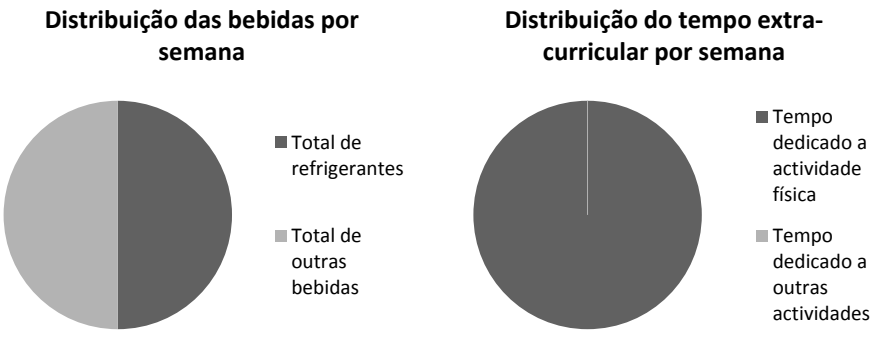

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E6 - SE A DISTRIBUIÇÃO FOR DADA POR:



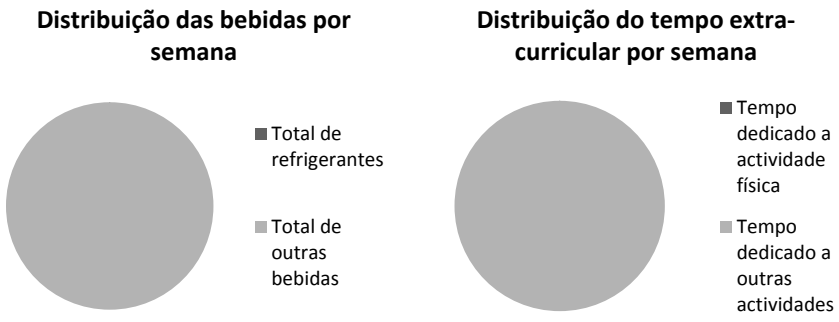

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E7 - SE A DISTRIBUIÇÃO FOR DADA POR:



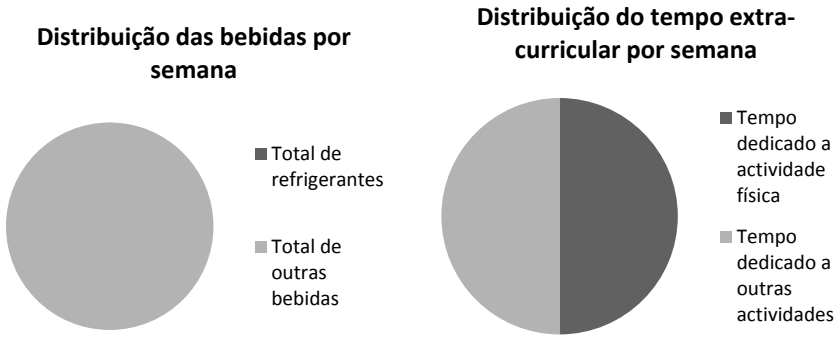

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E8 - SE A DISTRIBUIÇÃO FOR DADA POR:



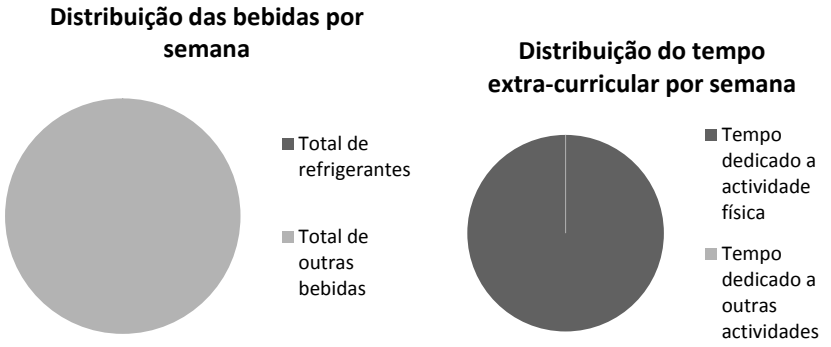

QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E9 - SE A DISTRIBUIÇÃO FOR DADA POR:




QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

E10 - SE A DISTRIBUIÇÃO FOR DADA POR:




QUAL A PROBABILIDADE DO/DA SEU/SUA FILHO/A SE TORNAR OBESO NOS PRÓXIMOS 12 MESES?

| **F- DISTRIBUIÇÃO DO TEMPO AO LONGO DO DIA** | |
|---|---|
| F1 – ENCONTRA-SE, NESTE MOMENTO, EMPREGADO? | 1. SIM<br>2. NÃO |
| F2 – NO CASO DE SER CASADO, O SEU CÔNJUGE ENCONTRA-SE, NESTE MOMENTO, EMPREGADO? | 1. SIM<br>2. NÃO |
| F3- DESEMPENHA ALGUM TIPO DE TAREFAS DOMÉSTICAS ? (LIMPAR, COZINHAR, IR AO SUPERMERCADO…) | 1. SIM<br>2. NÃO |
| F4- NO CASO DE SER CASADO , O SEU CÔNJ UGE DESEMPENHA ALGUM TIPO DE TARE FAS DOMÉSTICAS? (LIMPAR, COZINHAR, IR AO SUPERMERCADO…) | 1. SIM<br>2. NÃO |

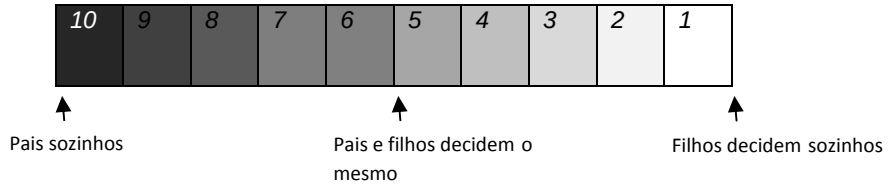
| | |
|---|---|
| F5 - QUANTO TEMPO DESPENDE, EM MÉDIA (EM MINUTOS), NUM DIA TÍPICO DE SEMANA NAS SEGUINTES ACTIVIDADES? | 1. TRABALHO PAGO (INCLUINDO DESLOCAÇÕES)<br>2. TRABALHO DOMÉSTICO (EXCL. A PREPARAÇÃO DAS REFEIÇÕES)<br>3. COZINHAR / PREPARAR REFEIÇÕES<br>4. TEMPO DEDICADO AOS FILHOS<br>5. ACTIVIDADES DE LAZER (SEM OS FILHOS) |
| F6 – QUANTO TEMPO É QUE O SEU CÔNJUGE **(NO CASO DE SER CASADO/A)** OU O OUTRO PAI **(NO CASO DE SER SOLTEIRO /A OU DIVORCIADO/A)** DESPENDE, EM MÉDIA (EM MINUTOS), NUM DIA TÍPICO DE SEMANA NAS SEGUINTES ACTIVIDADES? | 1. TRABALHO PAGO (INCLUINDO DESLOCAÇÕES)<br>2. TRABALHO DOMÉSTICO (EXCL. A PREPARAÇÃO DAS REFEIÇÕES)<br>3. COZINHAR / PREPARAR REFEIÇÕES<br>4. TEMPO DEDICADO AOS FILHOS<br>5. ACTIVIDADES DE LAZER (SEM OS FILHOS) |
| F7 – QUANTO TEMPO DESPENDE, EM MÉDIA (EM MINUTOS), NUM DIA TÍPICO DE FIM-DE-SEMANA NAS SEGUINTES ACTIVIDADES? | 1. TRABALHO PAGO (INCLUINDO DESLOCAÇÕES)<br>2. TRABALHO DOMÉSTICO (EXCL. A PREPARAÇÃO DAS REFEIÇÕES)<br>3. COZINHAR / PREPARAR REFEIÇÕES<br>4. TEMPO DEDICADO AOS FILHOS<br>5. ACTIVIDADES DE LAZER (SEM OS FILHOS) |
| F8 – QUANTO TEMPO É QUE O SEU CÔNJUGE **(NO CASO DE SER CASADO/A)** OU O OUTRO PAI **(NO CASO DE SER SOLTEIRO /A OU DIVORCIADO/A)** DESPENDE, EM MÉDIA (EM MINUTOS), NUM DIA TÍPICO DE FIM-DE-SEMANA NAS SEGUINTES ACTIVIDADES? | 1. TRABALHO PAGO (INCLUINDO DESLOCAÇÕES)<br>2. TRABALHO DOMÉSTICO (EXCL. A PREPARAÇÃO DAS REFEIÇÕES)<br>3. COZINHAR / PREPARAR REFEIÇÕES<br>4. TEMPO DEDICADO AOS FILHOS<br>5. ACTIVIDADES DE LAZER (SEM OS FILHOS) |

| **G- CABAZ DE CONSUMO** | |
|---|---|
| G1 – QUANTO É QUE GASTA POR MÊS, EM MÉDIA, EM VEGETAIS E FRUTA? | |
| G2 QUANTO É QUE GASTA POR MÊS, EM MÉDIA, EM PRODUTOS COM ALTO TEOR DE AÇÚCAR? (CHOCOLATES, DOCES, PIPOCAS, GELADOS. CEREAIS AÇUCARADOS, REFRIGERANTES…) | |
| G3 – QUANTO É QUE GASTA POR MÊS, EM MÉDIA, EM PRODUTOS COM ALTO TEOR DE GORDURA? (BATATAS FRITAS, DORITOS, FRITOS…) | |
| G4 – QUANTO É QUE GASTA POR MÊS, EM MÉDIA, COM AS CONTAS DA CASA? (ELECTRICIDADE, ÁGUA, TELEFONE, TVCABO, GÁS…) | |
| G5 – QUANTO É QUE GASTA POR MÊS, EM MÉDIA, COM DESPESAS DE EDUCAÇÃO? (MENSALIDADES DA ESCOLA, ACTIVIDADES EXTRA-CURRICULARES, LIVROS, EXPLICAÇÕES, MATERIAL ESCOLAR…) | |

| **H- HÁBITOS ALIMENTARES DA FAMÍLIA** | |
|---|---|
| H1 – COM QUE FREQUÊNCIA É QUE A SUA FAMÍLIA JANTA JUNTA? | 1. DIARIAMENTE<br>2. 4 A 5 VEZES POR SEMANA<br>3. 2 A 3 VEZES POR SEMANA<br>4. 1 VEZ POR SEMANA<br>5. MENOS DE 1 VEZ POR SEMANA |
| *QUESTÕES SOBRE OS HÁBITOS ALIMENTARES DA CRIANÇA REFERIDA NO INÍCIO DO INQUÉRITO* | |
| H2- QUANTAS PEÇAS DE FRUTA O /A SEU/SUA FILHO/A COME, EM MÉDIA, POR SEMANA? | 1. MENOS DE 1<br>2. ENTRE 1 E 3<br>3. ENTRE 4 E 7<br>4. ENTRE 8 E 10<br>5. MAIS DE 10 |
| H3- QUANTAS PORÇÕES DE VEGETAIS O /A SEU/SUA FILHO/A COME, EM MÉDIA, POR SEMANA?<br><br>(CONSIDERA-SE UMA PORÇÃO O EQUIVALENTE A DUAS COLHERES DE SOPA) | 1. MENOS DE 1<br>2. ENTRE 1 E 3<br>3. ENTRE 4 E 7<br>4. ENTRE 8 E 10<br>5. MAIS DE 10 |

| | |
|---|---|
| H4- QUANTOS REFRIGERANTES É QUE O /A SEU/SUA FILHO/A BEBE, EM MÉDIA, POR SEMANA? | 1. MENOS DE 1<br>2. ENTRE 1 E 3<br>3. ENTRE 4 E 7<br>4. ENTRE 8 E 10<br>5. MAIS DE 10 |
| H5 – QUANTOS DOCES É QUE O /A SEU/SUA FILHO/A COME, EM MÉDIA, POR SEMANA ? (REBUÇADOS, CHOCOLATES, GOMAS, GELADOS, DONUTS…) | 1. MENOS DE 1<br>2. ENTRE 1 E 3<br>3. ENTRE 4 E 7<br>4. ENTRE 8 E 10<br>5. MAIS DE 10 |
| H6 – QUANTOS "SNACKS" COM ELEVADO TEOR DE GORDURA É QUE O/A SEU/SUA FILHO/A COME, EM MÉDIA, POR SEMANA? (BATATAS FRITAS, DORITOS, FRITOS…) | 1. MENOS DE 1<br>2. ENTRE 1 E 3<br>3. ENTRE 4 E 7<br>4. ENTRE 8 E 10<br>5. MAIS DE 10 |

| **I- DECISÕES DE CONSUMO** | |
|---|---|
| I1 – O/A SEU/SUA FILHO/A EXPRESSA QUAL É O TIPO DE ALIMENTOS QUE QUER? | 1. NUNCA<br>2. RARAMENTE<br>3. OCASIONALMENTE<br>4. FREQUENTEMENTE<br>5. SEMPRE |
| I2 – RESPONDE POSITIVAMENTE AOS DESE JOS /VONTADES DO/DA SEU/SUA FILHO/A NA COMPRA DE PRODUTOS ALIMENTARES? | 1. NUNCA<br>2. RARAMENTE<br>3. OCASIONALMENTE<br>4. FREQUENTEMENTE<br>5. SEMPRE |
| I3 – O/A SEU/SUA FILHO/A ACOMPANHA-O NAS COMPRAS DE SUPERMERCADO / MERCEARIA? | 1. NUNCA<br>2. RARAMENTE<br>3. OCASIONALMENTE<br>4. FREQUENTEMENTE<br>5. SEMPRE |
| *IMAGINE AS DECISÕES DE CONSUMO, SOBRE UMA LISTA DE DIFERENTES PRODUTOS, NUMA IDA TÍPICA AO SUPERMERCADO. NUMA ESCALA DE 1 A 10 INDIQUE QUEM PARTICIPA NA DECISÃO DA ESCOLHA DOS PRODUTOS.* | |
| I4 – NA ESCALA DE 1 A 10, NUMA TÍPICA IDA ÀS COMPRAS, QUEM DECI DE O TI PO E A QUANTI DADE DE DOCES A SEREM COMPRADOS? | |
| I5 – NA ESCALA DE 1 A 10, NUMA TÍPICA IDA ÀS COMPRAS, QUEM DECI DE O TI PO E A QUANTI DADE DE REFRIGERANTES A SEREM COMPRADOS? | |
| I6 – NA ESCALA DE 1 A 10, NUMA TÍPICA IDA ÀS COMPRAS, QUEM DECI DE O TI PO E A QUANTI DADE DE VEGETAIS A SEREM COMPRADOS? | |
| I7 – NA ESCALA DE 1 A 10, NUMA TÍPICA IDA ÀS COMPRAS, QUEM DECI DE O TI PO E A QUANTI DADE DE FRUTA A SER COMPRADA? | |



**CHILDHOOD OBESITY IN PORTUGAL, 2011**
***QUESTIONNAIRE TO PARENTS***

*THE GOAL OF THIS STUDY IS TO EVALUATE THE DETERMINANTS OF CHILDHOOD OBESITY IN PORTUGAL.*
*I DEEPLY APPRECIATE TOTAL HONESTY IN THE ANSWERS GIVEN.*
*ALL INFORMATION IS STRICTLY CONFIDENTIAL, THE RESPONDENTS WILL NOT BE IDENTIFIED UNDER ANY CIRCUMSTANCE AND THE DATA COLLECTED WILL BE USED EXCLUSIVELY FOR ACADEMIC PURPOSES.*
*THE CHILD THAT THIS STUDY REFERS TO SHOULD BE ENROLLED IN THE 2ND OR 3RD YEAR OF THE PRIMARY EDUCATION.*

| **IDENTIFICATION** |
|---|
| PARENTS' ID: _____ |
| SCHOOL: _____ DATE: ___/___/___ |

| **A- SOCIO-DEMOGRAPHIC INFORMATION OF THE PARENT** | |
|---|---|
| A1 – GENDER | 1. WOMEN [ ]<br>2. MEN [ ] |
| A2 - AGE | [_____] YEARS |
| A3 - LEVEL OF SCHOOLING | 1. NO SCHOOL [ ]<br>2. PRIMARY EDUCATION [ ]<br>3. SECONDARY EDUCATION [ ]<br>4. UNIV. DEGREE [ ]<br>5. MASTER OR HIGHER [ ] |
| A4 – MARITAL STATUS | 1. SINGLE [ ]<br>2. DIVORCED / SEPARATED [ ]<br>3. WIDOWED [ ]<br>4. MARRIED / LIVING TOGETHER [ ] |
| A5 – HOW MANY CHILDREN DO YOU HAVE? | [_____] |
| A6 – HOW OLD ARE YOUR CHILDREN? | 1. [_____] [ ]<br>2. [_____] [ ]<br>3. [_____] [ ]<br>4. [_____] [ ]<br>5. [_____] [ ]<br>6. [_____] [ ] |
| A7 – HOW MUCH IS THE AVERAGE NET MONTHLY INCOME OF YOUR HOUSEHOLD (AFTER TAXES)? | 1. <500€ [ ]<br>2. 500-1500€ [ ]<br>3. 1500-2500€ [ ]<br>4. 2500-3500€ [ ]<br>5. 3500-5000€ [ ]<br>6. >5000€ [ ] |

| **B- HEALTH AND NUTRITION OF THE PARENT** | |
|---|---|
| B1 – WHAT IS YOUR WEIGHT? (IN KG) | [_____] |
| B2 – WHAT IS YOUR HEIGHT? (IN CM) | [_____] |
| B3 – DO YOU PRACTICE PHYSICAL EXERCISE? (PHYSICAL EXERCISE IS CONSIDERED ACTIVITIES OF MODERATE EFFORT AS RUNNING, SWIMMING, AEROBIC EXERCISES, GROUP SPORTS, FOR MORE THAN 30 CONSECUTIVE MINUTES). | [ ]<br>1. YES [ ]<br>2. NO |
| | |

| | |
|---|---|
| B4 – How many times per week do you practice physical exercise? | [_____] |

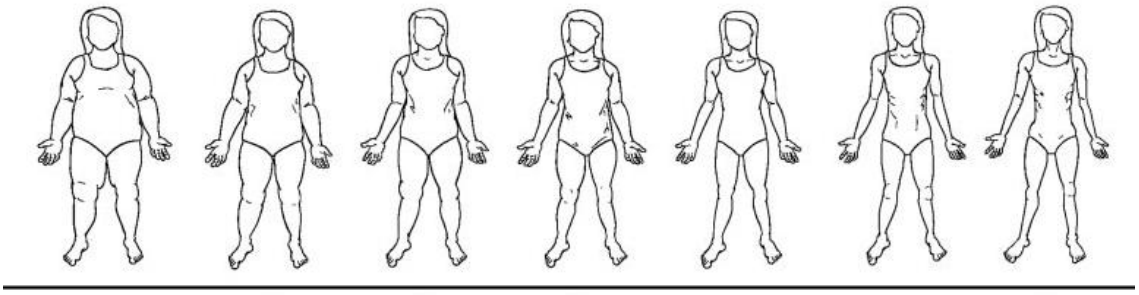
*(THE CHILD THAT THIS SECTION REFERS TO IS THE ONE IDENTIFIED IN THE BEGINNING OF THE QUESTIONNAIRE)*

| **C- Health and nutrition of the child** | |
|---|---|
| C1 – Your child is a boy or a girl? | 1. Girl [ ]<br>2. Boy [ ] |
| C2 – How old is your son/daughter? | [_____] Years |
| C3 – What is the weight of your son/ daughter? (in kg) | [_____] Kg |
| C4 – What is the height of your son/ daughter? (in cm) | [_____] Cm |
| C5 – Does your son/ daughter suffer from any chronic disease?<br><br>In not, skip to question C7. | 1. Yes [ ]<br>2. No [ ] |
| C6– From what chronic diseases does your son/daughter SUFFER?<br><br>(choose all that apply) | 1. Asthma [ ]<br>2. Diabetes [ ]<br>3. heart condition [ ]<br>4. high cholesterol [ ]<br>5. food disorder [ ]<br>1. other _____ [ ] |
| C7 – Does your son / daughter practice physical exercise? (activities of moderate effort as running, swimming, aerobic exercises, group sports, for more than 30 consecutive minutes). | 1. Yes [ ]<br>2. No [ ] |
| C8 – How many times per week does your son/ daughter practice physical exercise? | [_____] |

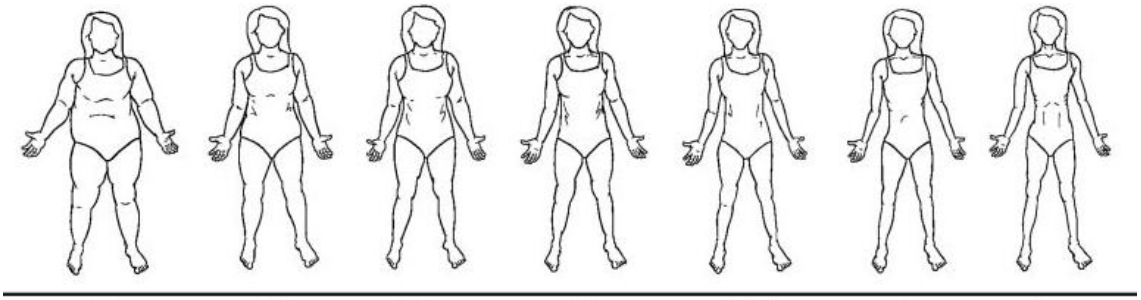
| **D – Perceptions** | |
|---|---|
| D1 – From a physical perspective, do you consider yourself to be _____? | 1. Very thin [ ]<br>2. Slightly Thin [ ]<br>3. With adequate weight [ ]<br>4. Slightly overweight [ ]<br>5. Very Overweight [ ] |
| D2 – – From a physical perspective, do you consider your son/ daughter to be _____? | 1. Very thin [ ]<br>2. Slightly Thin [ ]<br>3. With adequate weight [ ]<br>4. Slightly overweight [ ]<br>5. Very Overweight [ ] |

D3A – IF YOUR CHILD REFERRED TO IN THE BEGINNING OF THE QUESTIONNAIRE IS A GIRL **TICK (IN THE RESPECTIVE GREY BOX)** THE FIGURE THAT MOST RESEMBLES HER PHYSICAL CONSTITUTION, DEPENDING ON THE AGE RANGE.

1. IF YOUR DAUGHTER IS BETWEEN 6 AND 9 YEARS OLD

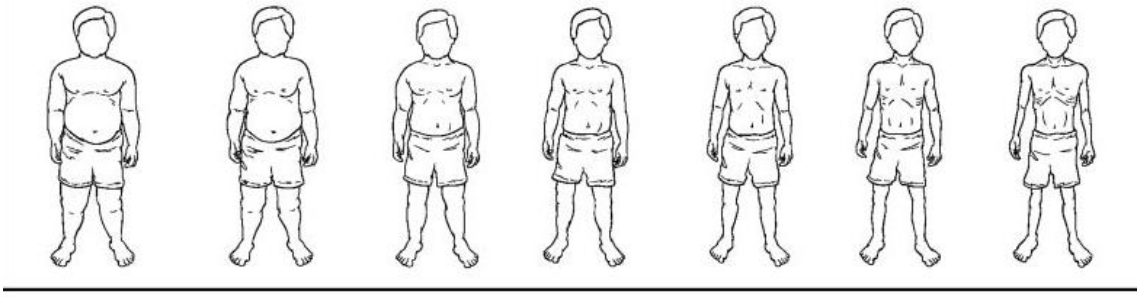


2. IF YOUR DAUGHTER IS BETWEEN 10 AND 13 YEARS OLD

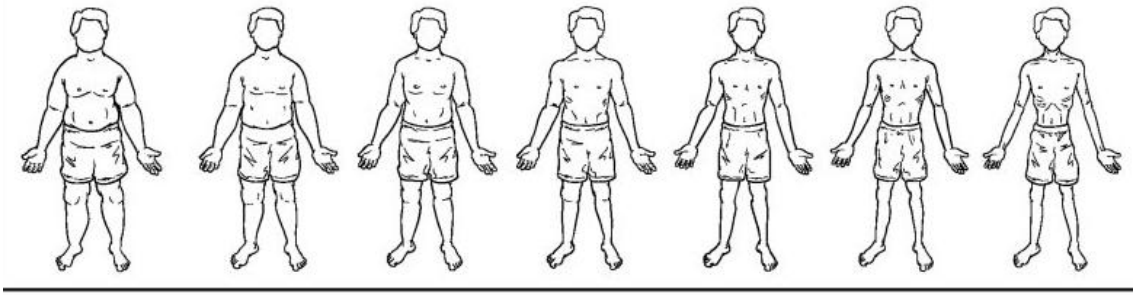


D3B– IF YOUR CHILD REFERRED TO IN THE BEGINNING OF THE QUESTIONNAIRE IS A BOY **TICK (IN THE RESPECTIVE GREY BOX)** THE FIGURE THAT MOST RESEMBLES HIS PHYSICAL CONSTITUTION, DEPENDING ON THE AGE RANGE.

1. IF YOUR SON IS BETWEEN 6 AND 9 YEARS OLD



1. IF YOUR SON IS BETWEEN 10 AND 13 YEARS OLD

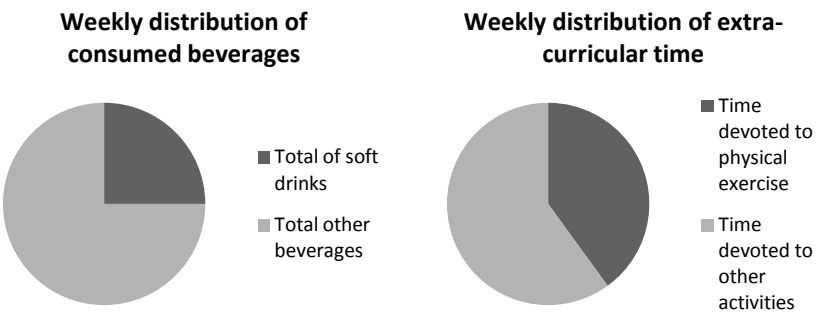


IN THE NEXT SECTION WE WILL MAKE SOME QUESTIONS ABOUT THE PROBABILITY THAT CERTAIN EVENTS OCCUR. THE PROBABILITY SHOULD BE A NUMBER BETWEEN 0 AND 100. NUMBERS LIKE 2% OR 5% CAN REPRESENT "ALMOST NO PROBABILITY", 19% REPRESENTS "NOT VERY PROBABLE", 47% OR 50% CAN REPRESENT "EQUALLY PROBABLE", AROUND 82% CAN REPRESENT "VERY PROBABLE" AND 98% "ALMOST CERTAIN".

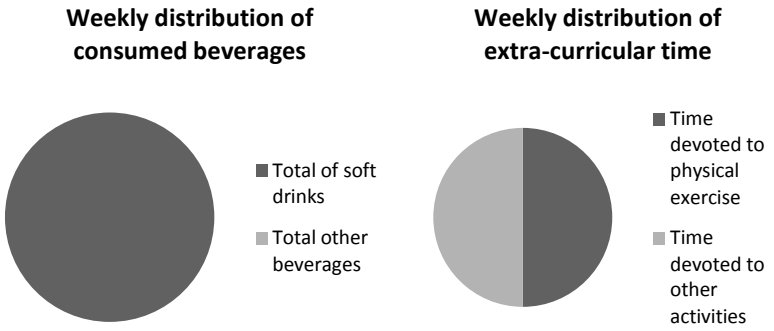
| **E – HYPOTHETICAL SITUATIONS** | |
|---|---|
| E0 (TEST-QUESTION) – WHAT IS THE PROBABILITY THAT IT WILL RAIN TOMORROW? | [_____] |
| E1 – WHAT IS THE PROBABILITY THAT YOUR SON / DAUGHTER WILL BECOME OBESE IN THE NEXT 12 MONTHS?<br><br>(IN PERCENTAGE) | [_____] |

IN THE NEXT QUESTIONS WE WILL ASK YOU TO IMAGINE DIFFERENT SCENARIOS REGARDING YOUR CHILD'S BEVERAGE CONSUMPTION AND THE WAY HE/SHE OCCUPIES HIS EXTRA-CURRICULAR TIME. NAMELY, ACROSS SCENARIOS WE WILL CHANGE:

- THE PROPORTION OF SOFT DRINKS (COKE, ICED-TEA, SPRITE) CONSUMED BY YOUR SON/DAUGHTER ON A WEEKLY BASIS, IN RELATION TO THE TOTAL AMOUNT OF CONSUMED BEVERAGES (INCLUDING WATER, MILK, NATURAL JUICE.)
- THE PROPORTION OF TIME DEVOTED TO PHYSICAL EXERCISE FROM YOUR SON/ DAUGHTER IN EXTRA-CURRICULAR ACTIVITIES ON A WEEKLY BASIS IN RELATION TO ALL OTHER NON-SCHOOL ACTIVITIES (WATCHING TV, VIDEOGAMES.)

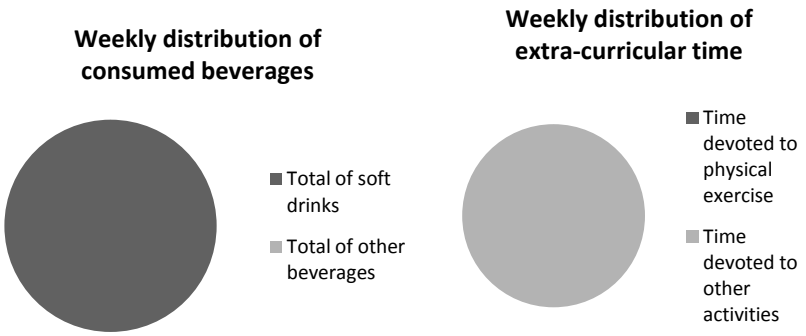



FOR EXAMPLE: IF YOUR SON / DAUGHTER ONLY DRINKS SOFT DRINKS AND DEVOTES HALF OF THE EXTRA-CURRICULAR TIME TO PHYSICAL ACTIVITY THE DISTRIBUTIONS OF CONSUMED BEVERAGES AND EXTRA-CURRICULAR TIME WOULD BE, RESPECTIVELY, GIVEN BY:



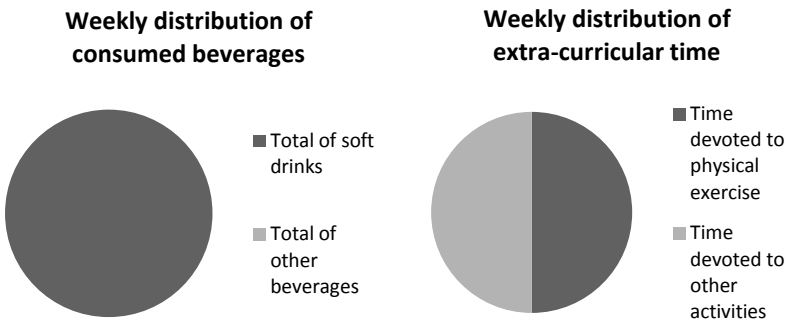

**CONSIDERING THE COMBINED EFFECT OF THE AMOUNT OF SOFT DRINKS AND THE TIME DEVOTED TO PHYSICAL EXERCISE, WHAT IS THE PROBABILITY OF YOUR SON / DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS?**

E2- IF THE DISTRIBUTION IS GIVEN BY:



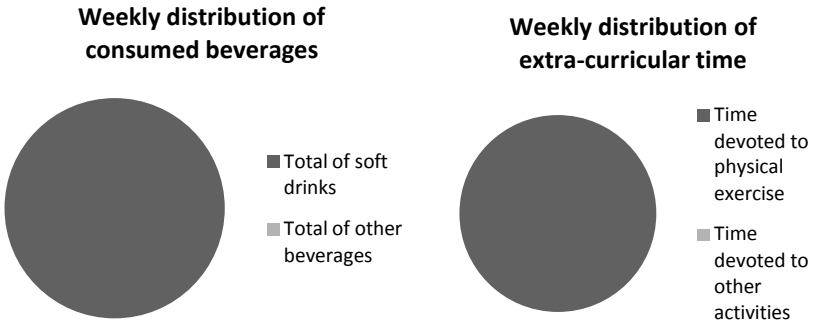

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E3- IF THE DISTRIBUTION IS GIVEN BY:



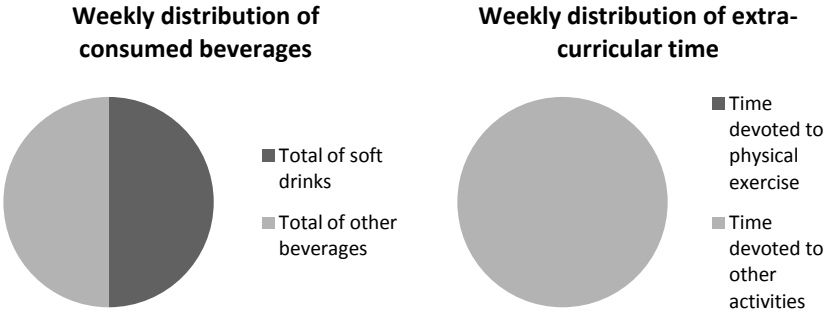

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E4 - IF THE DISTRIBUTION IS GIVEN BY:



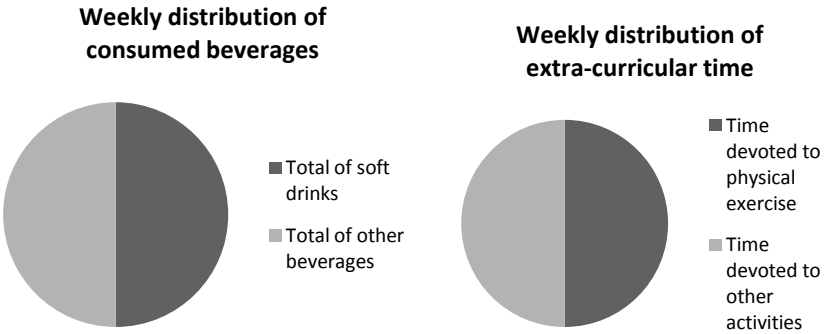

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E5 - IF THE DISTRIBUTION IS GIVEN BY:



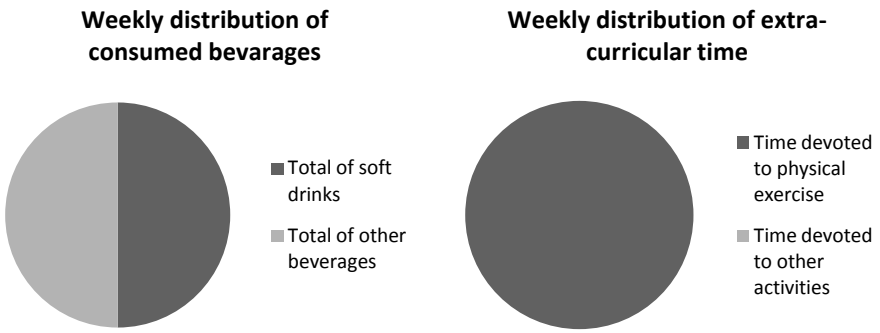

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E6 - IF THE DISTRIBUTION IS GIVEN BY:



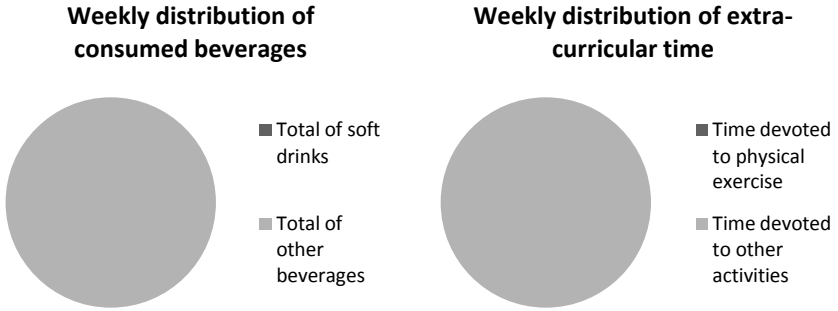

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E7 - IF THE DISTRIBUTION IS GIVEN BY:



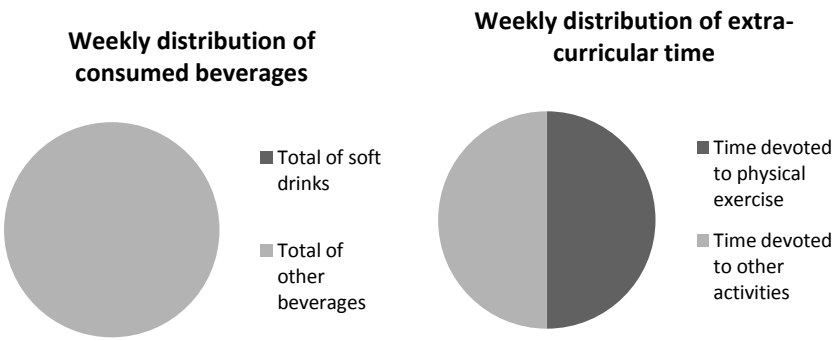

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E8 - IF THE DISTRIBUTION IS GIVEN BY::



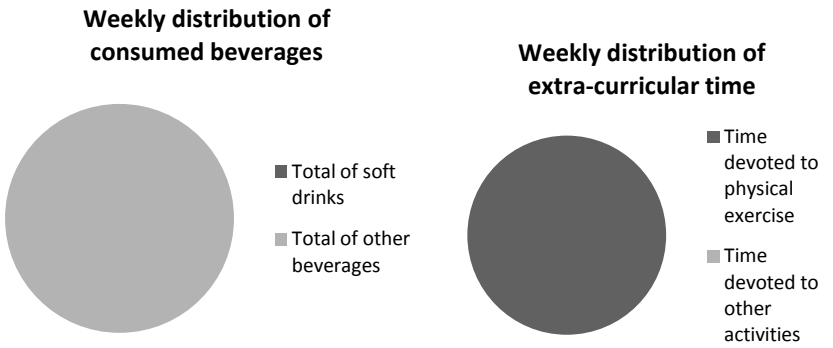

WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E9 - IF THE DISTRIBUTION IS GIVEN BY::




WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

E10 - IF THE DISTRIBUTION IS GIVEN BY:




WHAT IS THE PROBABILITY OF YOUR SON/ DAUGHTER BECOMING OBESE IN THE NEXT 12 MONTHS? [_____]

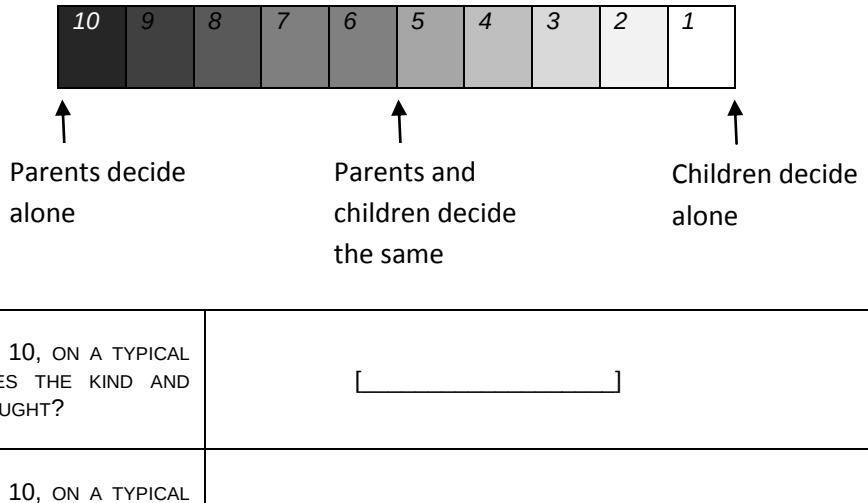
| F- DAILY TIME DISTRIBUTION | |
|---|---|
| F1 – ARE YOU CURRENTLY EMPLOYED? | 1. YES [ ]<br>2. NO [ ] |
| F2 – IF YOU ARE MARRIED, IS YOUR SPOUSE CURRENTLY EMPLOYED? | 1. YES [ ]<br>2. NO [ ] |
| F3- DO YOU DO ANY SORT OF HOUSEWORK? (CLEANING, COOKING, GROCERY SHOPPING) | 1. YES [ ]<br>2. NO [ ] |
| F4- IF YOU ARE MARRIED, DOES YOUR SPOUSE DO ANY SORT OF HOUSEWORK? (CLEANING, COOKING, GROCERY SHOPPING) | 1. YES [ ]<br>2. NO [ ] |
| F5 – HOW MUCH TIME DO YOU SPEND, ON AVERAGE, (IN MINUTES) IN THE FOLLOWING ACTIVITIES IN A TYPICAL **WEEK** DAY? | 1. PAID WORK (INCLUDING TRANSPORTATION) _:_<br>2. HOUSEWORK (EXCLUDING MEAL PREPARATION) _:_<br>3. COOKING / PREPARING MEALS _:_<br>4. DEVOTED TO CHILDREN _:_<br>5. LEISURE ACTIVITIES (WITHOUT CHILDREN) _:_ |
| F6 – HOW MUCH TIME DOES YOUR SPOUSE **(IF MARRIED)** OR THE OTHER PARENT **(IF SINGLE / DIVORCED)** SPEND, ON AVERAGE (IN MINUTES) IN THE FOLLOWING ACTIVITIES IN A TYPICAL **WEEK** DAY? | 1. PAID WORK (INCLUDING TRANSPORTATION) _:_<br>2. HOUSEWORK (EXCLUDING MEAL PREPARATION) _:_<br>3. COOKING / PREPARING MEALS _:_<br>4. DEVOTED TO CHILDREN _:_<br>5. LEISURE ACTIVITIES (WITHOUT CHILDREN) _:_ |
| F7 – HOW MUCH TIME DO YOU SPEND, ON AVERAGE, (IN MINUTES) IN THE FOLLOWING ACTIVITIES IN A TYPICAL **WEEKEND** DAY? | 1. PAID WORK (INCLUDING TRANSPORTATION) _:_<br>2. HOUSEWORK (EXCLUDING MEAL PREPARATION) _:_<br>3. COOKING / PREPARING MEALS _:_<br>4. DEVOTED TO CHILDREN _:_<br>5. LEISURE ACTIVITIES (WITHOUT CHILDREN) _:_ |
| F8 – HOW MUCH TIME DOES YOUR SPOUSE **(IF MARRIED)** OR THE OTHER PARENT **(IF SINGLE / DIVORCED)** SPEND, ON AVERAGE (IN MINUTES) IN THE FOLLOWING ACTIVITIES IN A TYPICAL **WEEKEND** DAY? | 1. PAID WORK (INCLUDING TRANSPORTATION) _:_<br>2. HOUSEWORK (EXCLUDING MEAL PREPARATION) _:_<br>3. COOKING / PREPARING MEALS _:_<br>4. DEVOTED TO CHILDREN _:_<br>5. LEISURE ACTIVITIES (WITHOUT CHILDREN) _:_ |

| G- CONSUMPTION BUNDLE | |
|---|---|
| G1 – HOW MUCH DO YOU SPEND, ON AVERAGE, ON FRUITS AND VEGETABLES? (IN EUROS) | [_____] |
| G2 - HOW MUCH DO YOU SPEND, ON AVERAGE, ON HIGH-SUGAR PRODUCTS? (CHOCOLATES, SWEETS, POPCORN, ICE-CREAM, SUGAR-ADDED CEREALS, SOFT DRINKS) | [_____] |
| G3 – HOW MUCH DO YOU SPEND, ON AVERAGE, ON HIGH-FAT PRODUCTS? (CHIPS, DORITOS, FRITOS) | [_____] |
| G4 – HOW MUCH DO YOU SPEND, ON AVERAGE, ON YOUR HOUSEHOLD BILLS? (ELECTRICITY, WATER, TELEPHONE) | [_____] |
| G5 – HOW MUCH DO YOU SPEND, ON AVERAGE, ON EDUCATION? (TUITION FEES, EXTRA-CURRICULAR ACTIVITIES, BOOKS, TUTORS) | [_____] |

| H- FAMILY FOOD HABITS | |
|---|---|
| H1 – HOW FREQUENT DOES YOUR FAMILY HAVE DINNER TOGETHER? | 1. DAILY [ ]<br>2. 4 TO 5 TIMES PER WEEK [ ]<br>3. 2 TO 3 TIMES PER WEEK [ ]<br>4. ONCE PER WEEK [ ]<br>5. LESS THAN ONCE PER WEEK [ ] |
| *QUESTIONS ABOUT THE FOOD HABITS OF THE CHILD REFERRED TO IN THE BEGINNING OF THE QUESTIONNAIRE* | |
| H2- HOW MANY PIECES OF FRUIT, ON AVERAGE, DOES YOUR SON / DAUGHTER EAT PER WEEK? | 1. LESS THAN 1 [ ]<br>2. BETWEEN 1 AND 3 [ ]<br>3. BETWEEN 4 AND 7 [ ]<br>4. BETWEEN 8 AND 10 [ ]<br>5. MORE THAN 10 [ ] |
| H3- HOW MANY PORTIONS OF VEGETABLES, ON AVERAGE DOES YOUR SON / DAUGHTER EAT PER WEEK? | 1. LESS THAN 1 [ ]<br>2. BETWEEN 1 AND 3 [ ]<br>3. BETWEEN 4 AND 7 [ ]<br>4. BETWEEN 8 AND 10 [ ]<br>5. MORE THAN 10 [ ] |
| H4- HOW MANY SOFT DRINKS, ON AVERAGE, DOES YOUR SON / DAUGHTER DRINK PER WEEK? | 1. LESS THAN 1 [ ]<br>2. BETWEEN 1 AND 3 [ ]<br>3. BETWEEN 4 AND 7 [ ]<br>4. BETWEEN 8 AND 10 [ ]<br>1. MORE THAN 10 [ ] |
| H5 – HOW MANY SWEETS, ON AVERAGE, DOES YOUR SON / DAUGHTER EAT PER WEEK? (CANDY, CHOCOLATE, ICE-CREAMS, DONUTS) | 1. LESS THAN 1 [ ]<br>2. BETWEEN 1 AND 3 [ ]<br>3. BETWEEN 4 AND 7 [ ]<br>4. BETWEEN 8 AND 10 [ ]<br>5. MORE THAN 10 [ ] |
| H6 – HOW MANY HIGH-FAT SNACKS, ON AVERAGE, DOES YOUR SON / DAUGHTER EAT PER WEEK? (CHIPS, DORITOS, FRITOS) | 1. LESS THAN 1 [ ]<br>2. BETWEEN 1 AND 3 [ ]<br>3. BETWEEN 4 AND 7 [ ]<br>4. BETWEEN 8 AND 10 [ ]<br>5. MORE THAN 10 [ ] |

| I- CONSUMPTION DECISIONS | |
|---|---|
| I1 – DOES YOUR SON/ DAUGHTER EXPRESS THE TYPE OF FOOD THAT HE/SHE WANTS? | 1. NEVER [ ]<br>2. RARELY [ ]<br>3. SELDOM [ ]<br>4. FREQUENTLY [ ]<br>5. ALWAYS [ ] |
| I2 – DO YOU RESPOND POSITIVELY TO THE WISHES / WILLS OF YOUR SON / DAUGHTER IN THE PURCHASE OF FOOD PRODUCTS? | 1. NEVER [ ]<br>2. RARELY [ ]<br>3. SELDOM [ ]<br>4. FREQUENTLY [ ]<br>5. ALWAYS [ ] |
| I3 – DOES YOUR SON/ DAUGHTER GO WITH YOU TO THE SUPERMARKET / GROCERY STORE? | 1. NEVER<br>2. RARELY<br>3. SELDOM<br>4. FREQUENTLY<br>5. ALWAYS |

*IMAGINE THE CONSUMPTION DECISIONS, ABOUT A LIST OF DIFFERENT PRODUCTS, ON A TYPICAL TRIP TO THE SUPERMARKET. IN A SCALE FROM 1 TO 10 INDICATE WHO PARTICIPATES IN THE CHOICE OF THE PRODUCTS:*




| | |
|---|---|
| I4 – ON A SCALE FROM 1 TO 10, ON A TYPICAL SHOPPING DAY, WHO DECIDES THE KIND AND QUANTITY OF SWEETS TO BE BOUGHT? | [_____] |
| I5 – ON A SCALE FROM 1 TO 10, ON A TYPICAL SHOPPING DAY, WHO DECIDES THE KIND AND QUANTITY OF SOFT DRINKS TO BE BOUGHT? | [_____] |
| I6 – ON A SCALE FROM 1 TO 10, ON A TYPICAL SHOPPING DAY, WHO DECIDES THE KIND AND QUANTITY OF VEGETABLES TO BE BOUGHT? | [_____] |
| I7 – ON A SCALE FROM 1 TO 10, ON A TYPICAL SHOPPING DAY, WHO DECIDES THE KIND AND QUANTITY OF FRUIT TO BE BOUGHT? | [_____] |